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CENTRAL INTELLIGENCE AGENCY

SCIENTIFIC INFORMATION REPORT

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This report presents unevaluated information extracted from recently received publications of the USSR, Eastern Europe, and China. The information selected is intended to indicate current scientific developments and activities and is disseminated as an aid to research in the United States.

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Table of Contents

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I. BIOLOGY

1. Darwin Honored

Unsigned editorial; Moscow, Zhurnal Vysshey Nervnoy, Deyatel'nosti, No 6, Nov/Dec 59, pp 797-798

This editorial commemorates the 150th anniversary of the birth of Charles Darwin and the 100th anniversary of the publication of his Origin of Species. The editor states that the Darwin theory revolutionized thinking in the natural sciences and placed these sciences on a solid materialistic foundation. V. I. Lenin is quoted as saying: "Darwin put an end to the idea that the species of animals and plants are not connected with anything, that they are accidental, godsent, and inalterable. Darwin was the first to place biology on a completely scientific basis and to declare that species are subject to variations and succession."

Darwin's theory was warmly received in the progressive circles of Russia. It has found favorable soil for development in the Soviet Union. D. I. Pisarev and K. A. Timiryazev were ardent proponents of Darwin's teachings. I. M. Sechenov was a staunch supporter of Darwinism and I. P. Pavlov, I. V. Michurin, and T. D. Lysenko gave Darwinism additional support.

I. P. Pavlov published an article in 1916 on the occasion of the 70th jubilee of K. A. Timiryazev. In this article I. P. Pavlov stated: "We are glad to express, even by this token gesture, a feeling of profound esteem for Klement Arkad'yevich Timiryazev for his outstanding contribution to science in our country and for his tireless struggle for real scientific analysis in biology."

All teachings of I. P. Pavlov concerning higher nervous activity rest entirely on a strictly materialistic foundation, and they contribute greatly to the Darwinian theory of transformation of the organic world. Pavlov demonstrated that evolution is clearly evidenced by the gradual increase in the complexity of functions of the higher branches of the brain, which is the guiding force in the complex relationship between animals and the outside environment. The conditioned reflex concept, based on the theory of evolution, paved the way for I. P. Pavlov's pupil, L. A. Orbeli, to undertake a systematic study of evolutionary physiology and evolutionary pathology of higher nervous activity.

I. P. Pavlov applied the evolutionary principle to the most complicated phenomena of the human brain. He showed that an extraordinary addition appears in the course of the evolutionary development of the animal world. This addition becomes evident during human development and consists of the second signal system, represented by words, speech, and abstract human thought.

2. Gibberellins Detected Biologically

"A Biological Test for Gibberellins," by A. N. Boyarkin and M. I. Dmitriyeva, Institute of Plant Physiology imeni K. A. Timiryazev, Academy of Sciences USSR; Fiziologiya Rasteniy, Vol 6, No 6, Nov/Dec 59, pp 741-747

"Sections of maize leaves taken with growing points and mesocotyles were employed as the test objects for detection of gibberellin activity. The reaction to gibberellin in such sections is much stronger than in leaves taken without growing points. Moreover, indoleacetic acid has only a slight inhibitory effect in this case. The sections are prepared in the light from 7-8-day-old etiolated maize seedlings in which the first leaf has burst through the coleoptile and protruded outwards by 1-3 cm. The total length of the sections is 35 mm (leaf 30 mm + mesocotyle 5 mm). From 10 to 12 sections are placed in small glasses 30 mm high and 15-17 mm in diameter, equal amounts (1-2 ml) of the investigated solution or water (the control) being preliminarily poured into the glasses. The glasses with the sections are placed in a dark thermostat at a temperature of 22-25° C and high humidity. The measurements are made after 2 or 3 days of incubation. A quantitative estimation of the activity is made by aid of parallel experiments with gibberellic acid solutions and using graphical interpolation."

3. Radioactive Strontium Absorption by Various Soil and Subsoil Minerals

"Absorption of Radioactive Strontium by Various Soil and Subsoil Minerals," by V. I. Spitsyn and V. V. Gromov; Moscow, Pochvovedeniye, No 12, Dec 59, pp 45-50

This report presents results of research on the degree of absorption of radioactive strontium ($Sr^{89,90}$) by 50 naturally occurring minerals most often found in soils and subsoils, both in the form of solutions free from other cations and in the presence of calcium and stable strontium ions.

Results of these experiments show that the minerals which possess the greatest absorption capacity with regard to radiostrontium are clay minerals (montmorillonite, kaolinite, and halloysite), mica and hydromica, peat, pyrolusite, phosphorites, and nephelinic syenites. Therefore, it should be expected that the entrance of radiostrontium into the soil and subsoil will be followed by a rise in its content due to the simple equilibrium conditions in which the above-mentioned minerals are present.

It has been determined that the capacity of naturally occurring minerals to absorb radiostrontium intensively is connected with their sorption capacity; however, the presence of calcium even in small quantities amounting to 100 mg/l markedly decreases the degree of absorption of microquantities of strontium from the solutions.

Radiostrontium which penetrates into the subsoil waters can migrate easily, and can be absorbed by living organisms.

4. Isotope Research for Forestry

"Isotope Research in the Scientific Institute for Forestry," by Erdeszeti Tudomanyos Intezet; Budapest, Nepszava, 17 Dec 59, p 8

The institute established an isotope laboratory one year ago, and since then the laboratory workers have conducted many useful experiments. For example, a significant experiment in determining the viability of oak trees by means of isotope injections was conducted and it was determined how quickly the trees absorb nourishment. On the basis of the experiment, foresters can determine which trees are viable and which are suitable for cutting. A photograph shows researcher Istvan Szalai examining the growth of a seedling, the seed of which was soaked in an isotope bath in order to stimulate germination.

II. CHEMISTRY

Analytical Chemistry

5. Use of Experimental Plasma Jet in Spectral Analysis

"Use of a Plasma Jet as a Source of Excitation in Spectral Analysis," by V. V. Korolev and E. Ye. Vaynshteyn, Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy; Moscow, Zhurnal Analiticheskoy Khimii, Vol 14, No 6, Nov/Dec 59, pp 658-662

In the work described, it was established that it is possible and advisable to use a plasma jet as a source of the excitation of spectra in spectral analysis. One of the possible designs of a plasma jet for this purpose is described. This is the design of the jet which was actually constructed and used in the work in question. It operates on the electric arc principle; in the experiments conducted, the plasma was cooled with argon or nitrogen. The principle of the operation of a jet of this type was described in an earlier paper by the authors (of Zhurnal Analiticheskoy Khimii, Vol 13, 1958, p 627).

Because the plasma is projected from the cylindrical orifice of the cathode with a velocity of several Mach, the operation of the jet is distinguished by an exceptional stability. The stability and reliability of a plasma jet are greater than those of other sources of excitation used in spectral analysis; by using it, a high degree of reproducibility can be achieved in the quantitative determination of a great number of elements. Both powders and solutions can be analyzed by employing a plasma jet. A particularly high precision is to be expected in the analysis of solutions by this method, as compared with the precision achieved on a flame photometer.

After the work described by the USSR authors had been completed, a a paper on the use of a plasma jet in the spectral analysis of solutions was published by Margosh and Scribner in Spectrochimica Acta, No 2, 1959, p 138.

The authors mention that plasma jets are used for cutting high-strength metal alloys.

6. Detonation Capacity of Mixtures of Acetylene and Oils With Liquid Oxygen

"The Detonation Capacity of Mixtures of Acetylene and Oils With Liquid Oxygen," by Engineers Z. B. Basyrov and V. G. Mikhedov; Moscow, Kislorod, Vol 12, No 5, Oct 59, pp 2-6

Determination of the critical cross-section ("diameter") of the stable detonation of mixtures of acetylene and some lubricating oils with liquid oxygen as affected by the weight ratio of the components and comparison of mixtures investigated with known explosives showed that a mixture of acetylene with liquid oxygen is close to nitroglycerine with respect to detonation capacity and that a mixture of spindle oil 12 with liquid oxygen lies between picric acid and trotyl. It was shown that mixtures of used oil with oxygen differ only slightly from mixtures of fresh, unused oils with oxygen as far as their detonation capacity is concerned. It follows from the results of the investigation described that accumulation of lubricating oil, particularly dripping oil, in air separation equipment must be regarded as dangerous.

7. Inflammability of Mipora in Oxygen

"Inflammability of Mipora in Oxygen Because of Electrization," by I. I. Shumskiy, Candidate of Technical Sciences; Moscow, Kislorod, Vol 12, No 5, Oct 59, pp 19-23

Mipora is a material used as insulation for vessels in which liquid oxygen is stored and transported. Being a dielectric, it accumulates static charges of considerable magnitude. When vapor evolved by liquid oxygen comes contact with electrically charged mipora, this material may ignite. Establishing of an electrically conducting connection between the outer surface of the vessel and the inner surface of the vessel's jacket filled with mipora and grounding of the outer surface of the jacket will prevent fires due to the ignition of mipora.

8. Application of Liquid Oxygen Explosives in USSR Mining Industry

"Application of Liquid Oxygen Explosives (oxyliquits) in the Mining Industry," by Zh. K. Graubits (deceased) and R. V. Orlov, Candidates of Technical Sciences; Moscow, Kislorod, Vol 12, No 5, Oct 59, pp 12-15

The technical and economic aspects of the application of liquid oxygen explosives in the USSR mining industry are discussed in detail. It is stated that application of the very efficient explosives of this type has not developed adequately in the USSR after their use on a large scale in the construction of Dneproges [Dnepr Hydroelectric Power Station] in 1927-1932 and in the mines of the Noril'sk Mining and Metallurgical Combine in 1943-1955 (2,000 tons of oxyliquit were used at Noril'sk). The reasons are the prevalent impression that liquid oxygen explosives are very difficult to apply and that their application is dangerous. This situation is contrasted with the extensive use of explosives of this type outside of the USSR, e.g., in the iron mines of Lorraine (France). As an advantage of liquid oxygen explosives, the authors mention the fact that the high costs of storing solid explosives will be eliminated. The problem of storage is particularly acute in localities removed from railroads, such as those in regions of the Far North and Far East. Another advantage is that liquid oxygen explosives can be produced on the spot from local raw materials. Safety precautions to be observed in connection with the handling and application of explosives of this type are discussed on the basis of work carried out in 1953-1956 at the Laboratory of Blasting, Institute of Mining of the Academy of Sciences USSR, and the Oxyliquit Plant of the Noril'sk Mining and Metallurgical Combine.

9. Effect of Ozone on Ignition of Hydrocarbons

"The Effect of Ozone on the Ignition of Hydrocarbons," by S. A. Kamenetskaya, N. A. Slavinskaya, and S. Ya. Pshezhetskiy, pp 33-42, Kinetika i Rasprostraneniye Plameni (Kinetic and Propagation of Flames), Publishing House of the Academy of Sciences USSR, Moscow, 1959, 52 pp

The effects of ozone on the induction period and the limits of ignition of butane, butylene, and cyclohexane in a mixture with oxygen were investigated. It was established that ozone lowers the lower limit of ignition and shortens the period of induction of ignition. The effects become stronger with increasing concentrations of ozone in the mixture and with decreasing temperatures. The effect of ozone on the ignition of butylene is considerably greater than that on the ignition of butane or cyclohexane. The effect of ozone on the ignition of cyclohexane does not differ much from its effect on the ignition of butane. Calculations based on the theory of thermal ignition indicate that ozone lowers the effective

energy of activation. The action of ozone consists essentially in a facilitation of primary reactions of the formation of active centers. The greater effectiveness of ozone in promoting the ignition of butylene, as compared with the ignition of butane, can be explained by the fact that ozone adds to the double bond of butylene.

10. Effect of Ozone on Velocity of Combustion of Hydrocarbons

"The Effect of Ozone on the Velocity of Combustion of Hydrocarbons," by V. M. Cherevnichenko, I. N. Pospelova, and S. Ya. Pshezhetskiy, pp 42-51, Kinetika i Rasprostraneniye Plameni (Kinetics and Propagation of Flames), Publishing House of the Academy of Sciences USSR, Moscow, 1959, 52 pp

In all cases when ozone was added to mixtures of normal butane with air and normal butane with oxygen an increase in the velocity of combustion was observed. Introduction of ozone into these mixtures increases the density and heat capacity of the mixture. It also reduces the heat conductivity. All of these conditions can only result in a reduction of the velocity of combustion. Consequently, these effects must be rather weak and are covered up by other effects produced by ozone. One of the predominant effects is an increase in the temperature of combustion due to the presence of ozone (for instance, addition of 1.48% of ozone by volume increases the temperature of combustion by 41°). An increase in the temperature of combustion results in an increased velocity of combustion. In experiments with butane-oxygen mixtures, it was found that addition of 27.3% of ozone increases the velocity of combustion by a factor of 2.5.

S. A. Kamenetskiya, S. Ya. Pshezhetskiy, and N. A. Slavinskaya, who studied the effect of ozone on the critical conditions of ignition of mixtures of butane with oxygen, found that there is a shortening of periods of induction and extension of the region of ignition (cf preceding abstract). The effects observed correspond to an increase of the reaction velocity by several orders. In the experiments described in this instance, it was found that after the same additions of ozone, there is an increase in the rate of combustion which corresponds to an increase in the reaction velocity by a factor of several units only. The conditions pertaining to the kinetics of the reaction in hydrocarbon flames in the presence of ozone cannot be interpreted fully as yet on the basis of experimental data that are available.

11. Reaction Velocity and Rate of Propagation of Flames in Gas Mixtures

"Calculation of the Over-All Reaction Velocity and the Velocity of Flames in Gas Mixtures," by O. A. Tsukhanova, pp 3-32, Kinetika i Rasprostraneniye Plameni (Kinetics and Propagation of Flames), Publishing House of the Academy of Sciences USSR, Moscow, 1959, 52 pp

In the work described, an attempt has been made to derive expressions for the velocity of flames and the maximum velocity of reactions occurring in gas mixtures in such a manner that the order of the reaction with respect to the fuel and with respect to oxygen can be calculated independently at any value of the energy of activation and that the energy of activation can be calculated without making assumptions in regard to a monomolecular or bimolecular order of the reaction.

By using the approximate formulas which have been derived, the over-all kinetics of the reaction of carbon monoxide with oxygen were calculated. Only experimental data pertaining to the dependence of the velocity of flame on the concentration of carbon monoxide for mixtures with air and mixtures with oxygen were used.

By employing the formulas which were derived and a function expressing over-all kinetics which was determined, the velocity of flame at a stoichiometric composition of the mixture was calculated for different concentrations of nitrogen. Furthermore, the maximum velocity of the flame at different compositions of the mixture and the dependence of the flame velocity on the concentration of carbon monoxide or oxygen at a constant concentration of oxygen or carbon monoxide were calculated. It was established that the calculated data were in good agreement with experimental results reported by J. van Wonterghem and A. van Tiggelen, Yahn, and G. A. Barskiy.

12. Flow of Chemically Active Gas With Constant Static Temperature in Adiabatic-Isothermal Nozzle

"The Adiabatic-Isothermal Nozzle," by V. F. Stepanchuk, Belorussian Polytechnic Institute Minsk; Minsk, Inzhenro-Fizicheskiy Zhurnal, Vol 2, No 8, Aug 59, pp 66-71

In various types of equipment, high velocities of chemically active gases are encountered. From this standpoint, an analysis of the flow of a compressible gas through a nozzle under conditions when the flow is accompanied by chemical transformations is of definite interest. It is best to consider isothermal expansion of gas taking place at a constant static temperature of flow. Furthermore, the process in question will be adiabatic: because of the high velocity of flow through the nozzle,

the time during which the gas remains in the nozzle will be very short, so that the heat transfer between the gas and the surrounding medium can be neglected. Thus, the process of expansion of gas under the conditions considered will be adiabatic and isothermic. Relationships are derived on the basis of which an adiabatic isothermal nozzle can be calculated and designed for applications involving fairly high rates of chemically active flow with a constant static temperature.

13. Pulsation of Diffusion Flames

"Concerning the Problem of the Pulsation of Difussion Flames," by V. I. Blinov, Power Institute imeni G. M. Krzhizhanovskiy, Moscow; Minsk, Inzhinerno-Fizicheskiy Zhurnal, Vol 2, No 8, Aug 59, pp 15-22

When diffusion combustion of gases and liquids takes place, fluctuations of flames are observed. If the velocity of the flow of gas from the burner is small, the flame does not exhibit any vibrations. When the velocity increases and reaches a certain critical value, the flame begins to undergo periodic vibrations: its height increases and decreases. When the velocity becomes still greater, the type of vibration of the flame changes: the upper part separates from the lower and burns to completion in this state. Still more complex phenomena occur when the velocity is increased beyond this point. Similar conditions are observed in the combustion of liquids. The phenomena observed with liquids depend on the volume velocity of combustion of the liquid. After a certain critical volume velocity has been exceeded, pulsation of the flame begins.

Results of experiments described in this article, which dealth with the combustion of solar oil, kerosene, and gasoline, made it possible to explain the vibration of flames and to derive a number of relationships underlying the phenomena observed. It was established that the pulsations of flames are closely connected with the turbulization of the convection stream which rises from the flame and that the relationships which have been established on the basis of experimental data and theoretical considerations can be explained only when the hydrodynamic aspects of the phenomenon are considered. The causes of the vibration of the flames in the diffusion combustion of liquid fuels burning in burners and a number of regularities observed in practice are explained. The results obtained are in agreement with Ya. B. Zel'dovich's theory of transition from laminar to turbulent behavior in a freely ascending jet rising from the flame.

The critical velocity at which pulsations arise has been calculated for solar oil, kerosene, and gasoline and found to be equal to 2.35 cubic centimeters per minute. The critical velocities for carbon monoxide, hydrogen, acetylene, and ethylene have also been calculated. The critical velocity was found to be highest for carbon monoxide, followed by the velocities for hydrogen, acetylene, and ethylene, in that order. The sequence found for these four gaseous fuels is the same as that established by A. I. Maklakov (cf. his dissertation entitled "Investigation of the Stability of Open Laminar Diffusion Flames, Kazan," 1955).

[For additional information on fuels and propellants, see Metallurgy.]

Growth Stimulators

14. Petroleum-Derived Growth Substance

"The Effect of Petroleum-Derived Growth Substance on the Organs of Mammals," by M. A. Akhundov, Azerbaydzhan State University imeni S. M. Kirov; Baku, Doklady Akademii Nauk Azerbaydzhan SSR, Vol 15, No 10, 1959, pp 955-957

In tests conducted by scientific workers of the Institute of Soil Science and Agrochemistry of the Academy of Sciences Azerbaydzhan SSR under the leadership of Prof D. M. Guseynov, it was established that a petroleum-derived growth substance used in microdoses stimulates the growth and development of plant organisms.

The harvest of agricultural crops was increased an average of 30-60% under the effect of the petroleum-derived growth-promoting substance both in laboratory and in field tests.

Tests of the effect of this substance on the organisms of animals have been made for the first time. After the addition of the growth substance to the wet feed of chicks, a 15-20% increase in weight was observed in comparison with control groups.

A similar effect was observed in silkworm caterpillars after dusting the leaves with the growth substance.

The petroleum-derived growth substance positively affects the organs of mammals. After its addition to rabbits' feed, calculated at 4-8 mg per kg of live weight, a greater weight increase is obtained than in the control groups. Thus, in 90 days, the control group increased in absolute weight from 41 to 318 g and the relative weight increase was 2.1-22%. The first group tested received 8 mg of growth substance per kg of live weight. Its absolute weight increased from 230 to 587 g and the relative increase was 17.4-43.7%.

Herbicides

15. Selective Dicotyledonous Herbicidal Activity Described

"A New Possibility of Producing Superselective Herbicides," by L. Ferenczy and B. Matkovics, Department of Plant Physiology and Department of Organic Chemistry, University of Szeged; Budapest, Acta Biologica Academiae Scientiarum Hungaricae, Supplement No 3, (Proceedings of the Third Meeting of the Hungarian
 Biological Society, Budapest, 5-7 May 1959), 1959, p 30

"It has been observed in our laboratory that some auxin precursors (i. e., 3-indoleacetonitrile, 3-indoleethylamine) exhibit a selective growth-promoting effect. On the basis of the selectrivity of indole derivatives as auxin precursors, we thought that probably derivatives of 2,4-dichlorophenoxyacetic acid, chemically related to the indole compounds, would also possess a selective effect. If this proved to be true, a new way would be open for the production of superselective herbicides, i. e., compounds capable of eradicating dicotyledonous weeds in dicotyledonous crops without damaging the cultivated plants.

"The weed-killing effect of 2,4-dichlorophenoxyacetonitrile (2,4-DN) and 2,4-dichlorophenoxyethylamine(2,4-DEA) was studied and the results obtained were compared with those obtained with 2,4-dichlorophenoxyacetic acid (2,4-D). The sensitivity of the nine cultivated plant species (all dicots) was assayed. Three-week-old plants were sprayed with a concentration of 500 g/ha.

"All the plant species tested were heavily damaged by 2,4-D. In 2 to 3 weeks a complete eradication was experienced. 2,4-DN exhibited a similar range of activity, except that cucumber plants were only slightly and temporarily damaged. 2,4-DEA was complete ineffective against hemp but eradicated the other plants involved.

"2,4-DEA--HCl was systhesized. The effect of this compound was identical to that of 2,4-DEA. Experimental spraying (1 kg/ha) indicated that none of the eight investigated hemp varieties was damaged by 2,4-DEA--HCl. By contrast, the successful control of various dicotyledonous weeds of hemp plots was achieved (Convolvuluv arvensis, Amaranthus albus, A. retroflexus, Lepidium draba and Sinapis arvensisi)."

16. Syntheses of Bromine Analog of Weed-Killer "2,4,5-T" Described

"Some Problems of Obtaining Weed Killers. XV. Method of Preparing 2,4,5-Tribromophenoxyacetic Acid (The Bromine Analong of 2,4,5-T)," by Zygmunt Eckstein and Elzbieta Szulcowa, Department of Organic Technology II, Institute of Technology, Warsaw; Roczniki Chemii, Vol 33, No 6, 1959, pp 1477-1483

"The synthesis of 2,4,5-tribromophenoxyacetic acid, a bromine analog of the known weed-killer "2,4,5-T," by two different methods is described.

"(1) 1,4-Dibromobenzene was subjected to nitration and subsequently reduced. The 2,5-dibromoaniline thus prepared was converted into 2,5-dibromophenol by diazotizing and then bringing the diazocompound to a boil. The phenol obtained in this reaction was condensed with chloroacetic acid to give 2, 5-dibromophenoxyacetic acid, which was brominated with active bromine in a solution of glacial acetic acid. Active bromine was produced in the reaction medium by the action of sodium chlorate on hydrobromic acid.

"(2) Ethyl 2,4-dibromophenoxyacetate when subjected to nitration and subsequently reduced to 2,4-dibromo-5-aminophenoxyacetic acid, which is converted to 2,4,5-tribromophenoxyacetic acid in the Sandmeyer reaction, yielded a product identical with that prepared by the previously described method."

17. Herbicide and Growth Stimulant for Winter Wheat: 2,4-Dichlorophenoxyacetic Acid

"A Chemical Method for Controlling Weeds in Winter Wheat," by S. G. Muftizade, Institute of Genetics and Selection Academy of Sciences Azerbaydzhan SSR; Baku, Doklady Akademii Nauk Azerbaydzhan SSR, Vol 15, No 9, 1959, pp 849-851

The best method for chemically controlling weeds in winter wheat under the Karabakh Plains conditions appears to be the use of 0.5-1.5 kg of the herbicide 2,4-D [dichlorophenoxyacetic acid] with the addition of 7 kg of ammonium nitrate and 15 kg of superphosphate. The best time for application appears to be in the middle of April.

The preparation 2,4-D is used not only for its herbicidal activity, but also because it is a growth promoter.

Inorganic Chemistry

18. Method for Production of Disilicides of High-Melting Metals

"The Preparation of Disilicides of High-Melting Metals," by G. V. Samsonov, M. S. Koval'chenko, and T. S. Verkhoglyadova, Institute of Powder Metallurgy, Cermets, and Special Alloys, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2759-2765

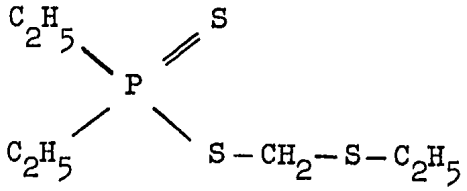
The conditions have been investigated under which the disilicides of Ti, Zr, V, Nb, Ta, Cr, Mo, and W can be prepared by the direct combination of metals with silicon in an atmosphere of argon. The optimum conditions for carrying out these reactions have been established and are given. The activation energies of the diffuse formation of disilicide phases from powdered metal and silicon have been calculated. It was established that the activation energy depends on the crystallization pressure effective in the formation of intermetallic compounds in the powder mixtures. A preliminary investigation has been carried out of the conditions under which the silicides of Ti, V, Nb, and Ta are formed when oxides of these metals are reduced with silicon in vacuum.

Insecticides

19. Method Employing Bromine for Quantitative Determination of Organophosphorus Insecticide

"A Method for Determining the Organophosphorus Insecticide L-11-6 in the Air of Working Premises," by Docent N. L. Nemirovskiy and G. I. Meyerovich, Chair of Work Hygiene and Laboratory of Organic Chemistry of the Leningrad Sanitary-Hygiene Medical Institute; Moscow, Gigiyena i Sanitariya, No 7, Jul 59, pp 80-81

A fast, simple method for determining the content of the organophosphorus insecticide L-11-6 in the air of working quarters is presented. This substance has the following chemical structure:



It is colorless, mobile liquid with peculiar odor. Its boiling point is 132° C. It is readily soluble in organic solvents but very poorly soluble in water.

The proposed method is based on the capability of this substance to react with bromine. A slight excess of bromine is introduced into a solution of the preparation (in ethyl alcohol) by reacting aqueous solutions of KBr, $KBrO_3$, and HCl according to the equation:

$$5KBr + KBrO3 + 6HCl \rightarrow 6KCl + 3H_2O + 3Br_2.$$

An excess of bromine will color the solution. A solution of KI is added to intensify the color in the solution of the investigated substance. The free bromine, reacting with the KI frees iodine. By back-titrating the free iodine with a solution of hypsulfite the quantity of bromine reacting with the preparation L-11-6 can be determined and consequently, the amount of that preparation estimated.

By using this method, one can determine quantitatively the insecticide when its content in alcohol is as low as 0.0001 mg/ml.

The method can be used to determine quantitatively other substances with which bromine reacts either by addition or by substitution.

The proposed procedure is very sensitive to OP-7 (polyethyleneglycolalkylphenyl ether), hence it cannot be used when OP-7 is present.

20. Field Tests Show Certain Chemicals Repel Ixodes Ticks for 2-3 Days

"Field Tests for the Effectiveness of the Repellent Action Exercised by Dimethylphthalate, Creolin, Diphenyloxide Terpineol, RP-1, and RP-50 on Ixodes ricinus L. Ticks," by P. K. Kuznetsov, Chair of General Biology of the Voronezh Medical Institute; Moscow, Meditsinskaya Parazitologiya i Parazitarnyye Bolezni, No 5, Sep/Oct 59, p 619

Field efficacy tests for the repellent action of dimethylphthalate, creolin, diphenyloxide, terpineol, RP-1, and RP-50 were conducted on ticks (Ixodes ricinus L.) during the warm seasons of 1956 and 1957. These tests showed that preparations RP-50, RP-1, creolin, and a solution of diphenyloxide in creolin manifest a repelling action for 2-3 days against these pests. Dimethylphthalate and terpineol manifested weak repellent activity against ticks.

At higher temperatures and lower relative humidity the repellent activity of these preparations is lost more rapidly.

A solution of diphenyloxide in creolin and pure creolin exhibited great toxicity toward these ticks in addition to a repellent action.

21. Kinetic Isotope Effect Affecting Hydrogen Exchange in Liquid Ammonia

"On the Kinetic Isotope Effect Affecting Hydrogen Exchange in Liquid Ammonia" by F. S. Yakushin, Yu. G. Dubinskiy, Ye. A. Yakovleva, and A. I. Shatenshteyn, Physico-Chemical Institute imeni L. Ya. Karpov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 12, Dec 59, p 2821

Data on the kinetic isotope effect operative during reactions of hydrogen exchange with bases have not been available hitherto. These data are essential for determining the mechanism of such reactions. To obtain information on the subject, the kinetics of the exchange for protium of tritium and deuterium contained in the methylene group of fluorene dissolved in ammonia were studied at 25°. It was established that the exchange of deuterium for protium proceeds twice as fast as the exchange of tritium for protium.

In earlier work carried out in the authors' laboratory, the similarity between relationships underlying the reactions of hydrogen exchange with strong bases, e. g., KNH_2 in liquid NH_3, and those pertaining to the metallization of organic compounds with organic compounds of alkali metals was noted repeatedly. It was demonstrated in published work done outside of the USSR that hydrocarbons containing tritium or deuterium are metallized at a correspondingly slower rate than compounds which do not contain these isotopes; the process of the introduction of metal atoms is regarded as protophilic substitution of hydrogen.

The data obtained in the work described in this instance indicate that a kinetic isotope effect also takes place during the exchange of hydrogen with bases. One may therefore assume that the stage which limits the velocity of both reactions is that of the scission of C-H bonds in the transitional state. Thus, the two reactions considered above have a similar mechanism; both take place as a result of the attack of a base on the hydrogen bound to carbon (C-H), i.e., as a consequence of an acid-base interaction between the hydrocarbon which functions as an acid and a reagent which is a base. All other characteristics of the reactions in question besides those noted are in accordance with this concept.

22. Ether and Ketone Solutions of Uranyl Nitrate

"Infrared Absorption Spectra of Ether and Ketone Solutions of Uranyl Nitrate," by Ya. I. Ryskin, V. P. Shvedov, and A. A. Solov'yeva; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 10, Oct 59, pp 2268-2275

The infrared absorption spectra of uranyl nitrate hydrates containing 2, 3, and 6 molecules of water and also thorium nitrate dissolved in diethyl ether and some ketones were investigated. The intrinsic vibrations of the NO_3^- ion modified by the effect of UO_2^{2+} ion have been identified. A scheme is proposed for the structure of concentrated ether and ketone solutions of uranyl nitrates on the basis of a concept postulating the presence of hydrated and solvated $UO_2(NO_3)_2$ adducts. In these adducts the interaction between UO_2^{2+} and NO_3^- is the same as in weakly hydrated (n equal to or lower than 2) uranyl nitrates crystal hydrates.

23. Dissociation Constants of Uranyl Oxalate Complexes

"Determination of Dissociation Constants of Oxalate Complexes of Uranyl by the Method of Displaced Equilibrium," by B. V. Ptitsyn and Ye. N. Tekster, Leningrad Technological Institute imeni Lensovet and Technological Institute of the Food Industry; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 10, Oct 59, pp 2248-2254

The values of the first, second, and over-all dissociation constants of the $[UO_2(C_2O_4)_2]^{2-}$ ion were determined by investigating the solubility of $Ag_2C_2O_4$ in solutions of uranyl nitrate and uranyl oxalate of different concentrations (i.e., by the second variant of the method of displaced equilibrium) and by investigating the interaction of solutions of the complex with silver nitrate (i.e., by the first variant of the method of displaced equilibrium).

24. Compounds of Uranyl Salts With Urea

"Compounds of Uranyl Salts With Urea", by V. P. Markov and I. V. Tsapkina, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 10, Oct 59, pp 2255-2260

A number of compounds of uranyl sulfate, uranyl chloride, uranyl nitrate, and ammonium uranyl dioxalate were synthesized. The formulas of the compounds in question are given. Some of the properties of the coordination compounds prepared are listed.

25. Compounds of Uranyl With 1,10-Phenantholine and 2,2'-Dipyridyl

"Compounds of Uranyl With 1,10-Phenanthroline and 2,2' Dipyridyl," by V. P. Markov and V. V. Tsapkin, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 10, Oct 59, pp 2,261-2,267

It was established that 1,10-phenanthroline and 2,2'-dipyridyl are capable of forming compounds with different uranyl salts both in alcoholic and aqueous solutions. Twenty-two compounds of this type were synthesized. Their composition and properties are given.

26. Sulfate Complexes of Tetravalent Plutonium in Nitric Acid Solutions

"Spectrophotometric Investigation of the Formation of Sulfate Complex Compounds of Pu IV in Nitric Acid Solutions," by A. A. Lipovskiy and N. B. Chernyavskaya; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 10, Oct 59, pp 2244-2247

The changes have been investigated which take place in absorption spectra of solutions of Pu IV in 1.5 N nitric acid with changing concentrations of potassium sulfate. It was established that in this case there is successive building up of sulfate complexes of Pu IV. Rapid changes in the intensity of absorption bands of Pu IV which occur after small quantities of sulfate ions have been added testify to the greater stability of the sulfate complexes as compared with nitric acid complexes. These changes must be taken into account when Pu IV is determined spectrophotometrically in nitric acid solutions.

27. Constitutional Diagram of System Titanium-Hafnium

"Constitutional Diagram of the System Titanium-Hafnium," by M. A. Tylkina, A. I. Pekarev, and Ye. M. Savitskiy, Institute of Metallurgy imeni A. A. Baykov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 10, Oct 59, pp 2,320-2,322

The constitutional diagram of the system titanium-hafnium was determined on the basis of determinations of melting points; X-ray, thermal, dilatometric, and microstructural analysis; and also on the basis of determinations of hardness, density, and electrical resistance. The results obtained are reported.

28. Separation of Tantalum From Niobium by Solvent Extraction

"Extraction of Tantalum and Niobium With Cyclohexanone From Sulfuric Acid Solutions," by Ya. G. Goroshchenko, M. I. Andreyeva, and A. G. Babkin; Moscow-Leningrad, Zhurnal Prikladnoy Khimii, Vol 32, No 9, Sep 59, pp 1904-1913

It was established in the work described that without the presence of complex-forming ions, neither niobium nor tantalum can be extracted with cyclohexanone. Addition of fluoride ions facilitates the extraction of tantalum with this solvent. Niobium can be extracted from sulfuric acid solutions when fluoride or thiocyanate ions are present. It was established that after fluoride ions have been introduced, tantalum for all practical purposes is extracted irreversibly from sulfuric acid solutions containing ammonium sulfate. Niobium, which is partly extracted under these conditions together with tantalum, can be completely re-extracted from the organic phase and is thus separated from tantalum. A method for the industrial separation of tantalum from niobium that is based on these characteristics can be applied to advantage. Pentoxides of the two elements are obtained in a very pure state by applying this method of separation. The experiments in question were carried out for the purpose of developing a procedure suitable for the separation of niobium from tantalum in connection with the treatment of loparite and perovskite concentrates.

29. Separation of Niobium From Titanium by Ion-Exchange Method

"Extraction and Separation of Niobium and Titanium From Oxalic Acid Solutions by an Ion-Exchange Method," by I. D. Fridman and I. N. Yudina, Central Scientific Research Institute of Geology and Prospecting; Moscow-Leningrad, Zhurnal Prikladnoy Khimii, Vol 32, No 9, Sep 59, pp 1914-1919

Extraction and separation of niobium and titanium with the use of the anion-exchange resin EDE 10P in its chloride form when these elements are present in oxalic acid solutions is achieving by the selective elution of niobium with a 2M (10%) solution of sodium chloride and elution of titanium with a 1 M solution of hydrochloric acid. The volume capacity of the resin as far as adsorption of niobium is concerned comprises 5.5% of the weight of the air-dry resin. After extraction of the niobium and titanium from the resin there is complete regeneration of the resin into its initial state. The ion-exchange method makes it possible to produce niobium pentoxide containing 1.8-2% of titanium dioxide by weight when the ratio of niobium pentoxide (Nb_2O_5) to titanium dioxide in the initial concentrate amounts to 1:0.8.

30. Experimental Investigation of Density of Heavy Water

"Experimental Investigation of the Density of Heavy Water," by S. L. Rivkin; Moscow, Atomnaya Energiya, Vol 7, No 5, Nov 59, pp 457-459

The density of heavy water was investigated at temperatures up to 300° C and pressures up to 100 kilograms per square centimeter. The measurements were carried out by employing a piezometer of constant volume. The method used is described and the results obtained are listed.

31. Experimental Investigation of Viscosity of Heavy Water

"Experimental Investigation of the Viscosity of Heavy Water," by D. L. Timrot and K. F. Shuyskaya; Moscow, Atomnaya Energiya, Vol 7, No 5, Nov 59, pp 459-462

The viscosity of heavy water was investigated by a capillary method developed by D. L. Timrot and applied earlier for the investigation of the viscosity of ordinary water. The results obtained, which apply to temperatures in the range of 15-280° C and pressures from 46 to 111.5 kilograms per centimeter square, are presented in the form of tables.

32. Experimental Investigation of Heat Capacity of Heavy Water

"Experimental Investigation of the Heat Capacity of Heavy Water," by S. L. Rivkin and B. N. Yegorov; Moscow, Atomnaya Energiya, Vol 7, No 5, Nov 59, pp 462-465

The heat capacity of heavy water was investigated by means of adiabatic constant flow calorimeter operating in a closed circuit. The method applied in the investigation is described in detail. The results obtained, which cover the range of 20-300° C, are reported.

33. Experimental Investigation of Heat Conductivity of Heavy Water

"Experimental Investigation of the Heat Conductivity of Heavy Water," by N. B. Vargaftik, O. N. Oleshchuk, and P. Ye. Belyakova; Moscow, Atomnaya Energiya, Vol 7, No 5, Nov 59, pp 465-468

The heat conductivity of heavy water was investigated in the range of 10-360° C by using the hot wire method.

[For additional information on nuclear fuels and reactor construction materials, see Electronics, Materials.]

Organic Chemistry

34. Synthesis and Characteristics of Some Fluoroalkylthiocyanates, Isothiocyanates, and Carbylaminehalides Described

"Fluoroalkythiocyanates, Isothiocyanates, and Carbylaminehalides," by N. N. Yarovenko, S. P. Motornyy, and L. I. Kirenskaya; Zhurnal Obshchey Khimii, Vol 29, No 11, Nov 59, pp 3789-3791

Fluoroalkylthiocyanates were obtained by reacting fluorinated alkylsulfenehalides with potassium cyanide:

$$RSCl + KCN \rightarrow RSCN + KCl$$

where R = $CFCl_2$, CF_2Cl, CF_2ClCF_2.

The reaction between isothiocyanates and chlorine proceeds in two stages. The first stage, the addition of two atoms of chlorine to the double bond, occurs without a change in the color of the reaction mixture. At the beginning of the second stage, coloration appears which is characteristic for sulfur dichloride:

$$CHF_2CH_2NH_2 \xrightarrow{CSCl_2} CHF_2CH_2N{=}C{=}S \xrightarrow{Cl_2} CHF_2CH_2N{=}C(SCl)Cl \xrightarrow{Cl_2} \cdots\rightarrow CHF_2CH_2NCCl_2.$$

The following new compounds in the series of fluorinated alkylthiocyanates, isothiocyanates, and carbylaminehalides were synthesized and characterized: fluorodichloromethyl-, difluoro-chloromethyl-, tetrafluoro-2-chloroethyl-, 2,2-difluoroethyl-,2-fluoro-2-chloroethyl-thiocyanates, 2,2-difluoroethylisothiocyanate and 2,2-difluoroethyl-carbylaminechloride.

35. Synthesis of Phenyltetrafluorophosphorus and of Several of Its Derivatives Described

"Phenyltetrafluorophosphorus and Its Derivatives," by L. M. Yagupol'skiy and Zh. M. Ivanova, Institute of Organic Chemistry of the Academy of Sciences Ukrainian SSR; Zhurnal Obshchey Khimii, Vol 29, No 11, Nov 59, pp 3766-3769

The author states that "at present only very few compounds are known which contain the grouping -C-P-F. Only the alkyl esters of methylfluorophosphinic acid have been studied, several of which are strong toxic agents (sarin, soman). Quite recently the alkylamides of alkylfluorophosphinic acids, the acid difluorides of alkylphosphinic acids, and the acid fluorides of methylalkylphosphinic acids have been described."

Having undertaken the study of compounds with the -C-P-F grouping, the authors synthesized phenyltetrafluorophosphorus and a number of its derivatives. Phenyltetrafluorophosphorus and two of its derivatives were obtained according to the following reaction:

$$RC_6H_4PCl + SbF_3 \rightarrow RC_6H_4PF_4 + SbCl_3$$

where R = H, CH_3, or Cl.

Phenyltetrafluorophosphorus, instead of the expected phenyl-difluorophosphorus, was also obtained by the reaction of phenyl-dichloro-phosphorus with antimony trifluoride:

$$3C_6H_5PCl_2 + 4SbF_3 \rightarrow 3C_6H_5PF_4 + 2Sb + 2SbCl_3.$$

The acid difluorides of arylphosphinic acids of the type $p\text{-}RC_6H_4POF_2$ where R = H, CH_3 or Cl were prepared from the corresponding acid dichlorides by replacing chlorine with fluorine with the help of zinc fluoride. Antimony trifluoride was found to be unsuitable for this reaction.

Also synthesized were several arylamine salts of the acid monofluorides of arylphosphinic acids of the type $p\text{-}RC_6H_4P(O)(F)ONH_3C_6H_4\text{-}R'\text{-}p$ where R = H and R' = H; R = H and R' = CH_3; R = Cl and R' = CH_3; R = CH_3 and R' = H.

Physical constants of the synthesized compounds are given in three tables.

36. Method of Replacing Mobile Hydrogen Atom in Alcohols Mercaptans and Secondary Amines by Trihalomethyl Group Described

"Trihalomethylation of Organic Compounds," by N. N. Yarovenko and A. S. Vasil'yeva; Zhurnal Obshchey Khimii, Vol 29, No 11, Nov 59, pp 3786-3787

This reaction proceeds in two stages: (1) the introduction of a halothiocarbonyl group into the organic molecule; (2) the substitution of the thiocarbonyl sulfur with chlorine.

$$RSH \xrightarrow{CSCl_2} RSC(=S)Cl \xrightarrow{Cl_2} RSCCl_3$$

$$R_2NH \xrightarrow{CSCl_2} R_2NC(=S)Cl \xrightarrow{Cl_2} R_2NCCl_3$$

By trichloromethylation one can obtain thioethers sulfides from thioalcohols (thiols) and tertiary amines from secondary amines with the trichloromethyl group at the sulfur or the nitrogen, respectively.

By the chlorination of esters and thioesters of fluorocarbonic acid, compounds containing the fluorodichloromethyl group at the heteroatom can be prepared.

37. Electron Paramagnetic Resonance Study of Polymerization in Acrylonitrile-Magnesium Mixtures Obtained by Molecular Beam Condensation

"Electron Paramagnetic Resonance Study of Polymerization in an Acrylonitrile-Magnesium System Obtained by Molecular Beam Condensation," by V. A. Kabanov, G. B. Sergeyev, V. P. Zubov, and V. A. Kargin, Moscow State University; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 1, No 12, Dec 59, pp 1859-1861

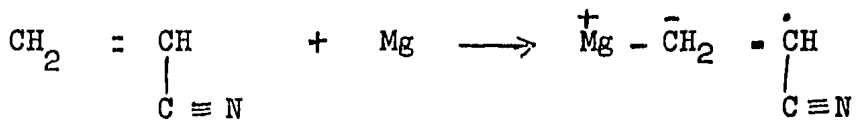
It was established by the authors of this article that by the simultaneous condensation of molecular beams of some inorganic substances and monomers on a surface cooled to a very low temperature systems are obtained in which polymerization of these monomers proceeds with a high velocity at extremely low temperatures (cf Vysokomolekulyarnyye Soyedineniya, Vol 1, 1959, pp 265 and 1422). The inorganic substances, on being dispersed to a monomolecular state, function as active initiators and catalysts of polymerization, exerting an action which they are incapable of producing when present in the state of crystals. One of the varieties of systems of this type consists of frozen mixtures of magnesium atoms and molecules of monomers containing vinyl groups, e. g., acrylonitrile or methyl methacrylate. Mixtures of this type are produced by condensing magnesium togehter with the monomer in vacuum on a surface cooled with liquid nitrogen. Polymerization in these mixtures begins at temperatures considerably lower than the melting point of the monomer and proceeds with a very great velocity, sometimes the velocity of an explosion. In the case of a mixture of acrylonitrile with magnesium, the temperature at which polymerization begins lies in the vicinity of minus 140°, while the melting point of acrylonitrile is minus 82°. In a mixture of methyl methacrylate with magnesium, the methyl methacrylate, which has a melting point of minus 50°, begins to polymerize in the region of minus 100°.

The mechanism by which the frozen monomers, which are in the solid state, polymerize at the temperatures indicated is of considerable interest. Development of a reaction chain in the frozen monomer by a coordination mechanism or ionic mechanism is unlikely. It must be assumed that a radical mechanism is effective. This assumption was confirmed by electron paramagnetic resonance measurements carried out on a Mg-acrylonitrile mixture in an experimental arrangement, which is described. Comparison with a sample of 1,1-diphenyl-2-picrylhydrazyl (DPPH) of known concentration indicated

that the quantity of radicals present in the system is of the order of 10^{18} rad/gram. The magnitude of the g-factor of the radicals present was found to be close to that of the g-factor of DPPH (2.0036). The concentration of radicals did not decrease at room temperature: the polymer radicals that had formed were "captured" in the structure of the solid polymer and preserved.

A control paramagnetic resonance measurement carried out after separate condensation of magnesium and acrylonitrile under the same conditions showed that no radicals were present.

The formation of radicals from the monomer may proceed as follows:



38. Dispersion of Liquids in Infrared

"Measurement of Dispersion in Regions of Intensive Infrared Absorption," M. P. Lisitsa and Yu. P. Tsyashchenkc, Kiev State University; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 108-112

A reflection method facilitating the study of dispersion of liquids inside intensive vibrational absorption bands is described. The interference method of measuring dispersion in approaching such bands is improved. As examples, dispersion curves of CCl_4 and $CHCl_3$ in regions of strongest absorption are obtained. The application of the devised method is of particular advantage in the study of volatile liquids.

Radiochemistry

39. Radiation-Chemical Vulcanization of Stereoregular Propylene-Isoprene Copolymer

"Synthesis and Investigation of Stereoregular Propylene-Isoprene Copolymers," by N. S. Volkova, G. V. Khutareva, B. A. Krentsel', Z. A. Rogovin, and A. V. Topchiyev, Moscow Textile Institute and Institute of Petrochemical Synthesis, Academy of Sciences USSR; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 1, No 12, Dec 59, pp 1758-1763

A stereoregular propylene-isoprene copolymer was synthesized. In the experiments conducted, Al $(C_2H_5)_3$ + $TiCl_4$ and $Al(C_2H_5)_3$ + $TiCl_3$ were used as catalysts. The copolymer obtained contained

only a very small percentage of diene bonds. Its chemical vulcanization proved impossible. The propylene-isoprene copolymer was vulcanized by exposing it to high-intensity gamma-radiation in vacuum.

Miscellaneous

40. First Yugoslav Congress on Pure and Applied Chemistry Announced

"First Congress on Pure and Applied Chemistry Will Be Held 15-21 June" (unsigned item); Belgrade, Borba, 17 Jan 60, p 2

The First Congress on Pure and Applied Chemistry in Yugoslavia, organized by the Union of Chemical Societies (Unija hemiskih drustava), will be held 15-21 June 1960. The main proceedings of the congress will take place in Zagreb 15-19 June. The congress will hold symposiums on the teaching and history of chemistry on 20 June in Rijeka. The last day of the congress will be held in Belgrade in connection with the opening of the Third Chemical Industry Exhibition.

The congress will cover the fields of organic, inorganic, and physical chemistry, analytical and applied chemistry, biochemistry, and chemical engineering.

41. Gravimetric Survey in Freiberg Mining Region

"Geophysical Prospecting Studies in the Freiberg-Brand (Saxony Erzgebirge) Region," by I. Berger, Leipzig; Leipzig, Geophysik und Geologie, Series 1 (no date), pp 35-47

In a geophysical survey of the granitic ore-bearing strata of the Freiberg-Brand region by gravimetric methods, it was found that the ordinary methods of interpretation could not be applied, since the Bouguer chart could not be interpreted because of the strong regional gradient. Various methods were used in an attempt to eliminate this regional gradient and thereby reveal the local anomalies. This was done with the average-value, gradient, and U_{zzz} -method (third-derivative method). In the calculation, formulas and measurement intervals were used which would best accentuate a disruptive formation at a depth of about 1,000-2,000 meters. The concurrence of all representations was relatively good. Certain primary anomalies were observed repeatedly. Among these, a minimum west of Freiberg was of special interest, since it could not be correlated with surface geology and could thus afford a starting point for the location of the granite arch being sought. This assumption is further supported by mineralogical prospecting viewpoints, since most Freiberg ore veins dip toward the west. This is, nevertheless, only one possible interpretation, since the density changes in the gneiss could cause the minimum. These assumptions were partially limited by magnetic measurements which proved that the density disturbances near the surface do not coincide with susceptibility changes.

IV. ELECTRONICS

Communications

42. Radio Receiver "Minsk"

"Radio Receiver 'Minsk,'" by Ya. Slepyan and I. Kaplan; Moscow, Radio, No 12, Dec 59, pp 23-24

The transistorized radio receiver "Minsk" was designed at the Minsk Radio Plant and the Leningrad Institute imeni A. S. Popov (Institute of Radio Broadcasting and Acoustics).

"Minsk" is a superheterodyne type receiver and incorporates seven (three type P-402, two type P-13A, and two type P-8) diffusion-type junction transistors. The range of operating frequencies is divided into two subranges: a long-wave subrange from 150 to 415 kc and medium-wave subrange from 520 to 1,600 kc. The sensitivity of the receiver when connected to an outdoor antenna is at least 100 microvolts for the long-wave subrange and 70 microvolts for the medium-wave subrange. For operation with an indoor magnetic antenna, the sensitivity in not at least 1.5 millivolt/m for the long-wave subrange and 800 microvolt/m for medium-wave subrange. Noise attenuation from adjacent and image channels is at least 26 db for long-wave subrange and 20 db for medium-wave subrange. The frequency converter incorporates one type P-402 transistor, the two-stage IF amplifier utilizes two type P-402 transistors, and the three-stage audio amplifier has type P-13A and P-8 transistors. The receiver power output is 0.4 w. and it can draw power either from six "Saturn" cells (100 hr service) or from a conventional ac power line. The over-all dimensions of the receiver are: 320 x 245 x 173 mm and it weighs 4 kg.

43. Prospects for Transistorized Automatic Telephone Exchanges

"Design of Small-Capacity Automatic Telephone Exchanges Using Semiconductor Instruments," by V. V. Shtager, M. A. Samokish, and V. K. Kaprov; Moscow, Elektrosvyaz', No 12, Dec 59, pp 57-66

"Methods for introducing electronics in telephone technology and trends in the field of developing fully electronic systems of automatic telephone exchanges are examined. In accordance with the two basic trends in this field, the authors give block-diagrams of

stations with spatial channel separation (having the possibility of expanding station capacity from 20 to several hundred numbers) and stations with time-pulse channel separation having a capacity of 100 numbers. Both block diagrams are designed for the use of Soviet manufactured semiconductor instruments as the basis for all units of the stations. A description is given of the principal circuits of the basic units of an electronic automatic telephone exchange with time-pulse channel separation."

The authors conclude that, for mass production of electronic automatic telephone exchanges of even small capacity, it will be necessary to greatly improve the status of semiconductor technology, for example, by increasing the life of semiconductor instruments, by improving the stability of their characteristics, and by decreasing their cost.

44. Protective Ratios for Maximum Quality FM Reception

"Protective Ratios in Ultrashort-Wave FM Broadcasting Networks," by B. I. Savitskiy and R. A. Kotikova; Moscow, Elektrosvyaz', No 12, Dec 59, pp 3-9

To maintain a given reception quality for FM broadcast receivers, it is necessary to establish protective ratios for FM networks. Such ratios may be used as the basis for planning high-quality multiprogram networks which are relatively free from interference by neighboring stations and by territorially remote FM stations operating at approximately the same frequencies.

Methods for experimentally determining two-signal and three-signal protective ratios are given and a number of rational principles and norms for protective ratios useful in planning ultrashort-wave FM networks are developed. Results of experiments are presented in a table of values for three-signal protective ratios recommended as norms for FM broadcasting networks with a maximum frequency deviation of ± 50 kc.

45. Signal Distortion in Single-Side-Band Communications

"Nature of Signal Distortion in Single-Side-Band Telephone Systems of Tropospheric Propagation Communication Lines," by M. P. Dolukhanov; Moscow, Elektrosvyaz', No 11, Nov 59, pp 12-16

A theoretical calculation is presented which shows that for a single-side-band telephone communication based on troposheric propagation, none of the transient distortions are formed during the actual process of signal propagation and that the only distortions present are in the form of attenuations and doppler frequency shift. The instantaneous frequency deviation, apparently, does not exceed a few cycles; however, the absolute value of such deviation can be determined only experimentally.

The author expresses gratitude to I. G. Klyatskin and V. V. Palshkov for valuable assistance.

46. Theory and Application of Two-Side-Band Modulation

"Two-Side-Band Amplitude Modulation and Its Utilization for the Simultaneous Transmission of Two Signals," by B. M. Pevzner; Moscow, Elektrosvyaz', No 12, Dec 59, p 17-25

The purpose of this work is to discuss the known material on two-side-band modulation, to supplement this material with certain necessary studies, and to determine the possibility of using two-side-band modulation in electrical communications. (By two-side-band amplitude modulation is meant amplitude modulation of the positive half waves of oscillations of a carrier frequency by one signal and modulation of the negative half-waves by a different signal. The "double-message" system of color television employs a method of transmission similar to that of two-side-band amplitude modulation.)

The properties of a two-side-band modulated signal are analyzed with particular emphasis on cross distortion of signals in a quasi-stationary regime and their relationships to the width of the frequency spectrum, percentage modulation, and shape of the carrier. Methods of compensating for and correcting distortion and basic methods for obtaining two-side-band modulation are discussed.

The advantages of two-side-band modulation are the simplicity of separating signals in the receiver and the noncritical nature of phase characteristics of the channel. Disadvantages

are the high value of cross distortions, criticalness of frequency characteristics of the channel, and the impossibility of mixing with a low-frequency (third) signal.

47. Television Receiver "Komsomolets"

"TV Receiver 'Komsomolets,'" by K. Runov and B. Aliyevskiy; Moscow, Radio, No 9, Sep 59, pp 26-28

At the "Radioelectronics" pavilion of the All-Union National Economy Achievements Exposition two television receivers scheduled for mass production were demonstrated: the "Komsomolets" of the Leningrad Sovnarkhoz and "Mayak" of the Vladimirskiy Sovnarkhoz. The television receivers "Komsomolets" and "Mayak" are assembled with individual block-units, utilizing many components, such as printed circuits, etc., of advanced technology.

The "Komsomolets" has an especially well-defined block-unit assembly; here each block-unit performs a specific function, such as IF amplification, AF amplification, etc. The block-unit construction of these receivers will facilitate automated mass production. The "Komsomolets" has seven functional block-units: a 12-channel selector switch, IF and video-signal amplifier, IF and AF amplifier, loudspeaker with output transformer, horizontal scan unit, vertical scan unit, and power supply pack. The sensitivity of the set is about 200 microvolts, and adjacent video-channel selectivity about 20 db. The screen image has about 500 lines and at least seven gradations of brightness. The 35LK2B picture tube has a 285 x 215 mm screen. The set consumes about 130 w and weighs about 16.5 kg. The set incorporates 12 tubes as follows: two 6Zh1P, one 6Zh5P, one 6P15P, two 6P14P, two 6F1P, one 6N1P, one 6P13S, one 6Ts10P, and one 1Ts11P.

48. New Radio Communication Equipment

"Along the Road of Technical Progress," by N. D. Psurtsev, Minister of Communications USSR; Moscow, Radio, No 11, Nov 59, pp 12-13

The article contains the following.

"In certain cases we [Ministry of Communications USSR] have serious complaints against industry workers and some scientific research institutes of the State Committee on Radioelectronics. In many instances they design individual equipment and subsequently

introduce it to industry at an exceedingly slow pace. For example, the automatic short-wave transmitter 'Molniya' has been in the process of design since 1956 at one of the design bureaus of the State Committee on Radioelectronics. Its first experimental prototype is not scheduled for completion until 1961. Approximately in the same period the designers have been working on microwave radio receivers for radio-relay points. A delay occurred in the design of the 5/1.5-kw transmitting television radio station for operation in the frequency range of 174-230 Mc. Its prototype is only now being installed for a test run. The design of television transmitters and receivers for the frequency range of 470-960 Mc, which are needed for further development of television broadcasting, has not yet been properly organized.

"The communications workers are justified in registering some dissatisfaction with regard to design of vacuum and semiconductor components. Many of the vacuum-electronic and semiconductor instruments now manufactured are rather expensive and are designed for an inadmissibly short period of service.

"The present television broadcasting frequency ranges of 48.5-100 Mc and 174-230 Mc assure, in reality, only one program. To realize transmission to a large number of localities of a second program also, it would be necessary to introduce a new broadcasting range of 470-960 Mc."

49. Hungarian-Soviet Cooperation on Wide-Band Microwave Equipment

"Hungarian-Soviet Signal Technology Scientific Cooperation Is Strengthening" (unsigned article); Budapest, Nepszabadsag, 6 Jan 60 p 3

This article reports that a new type of wide-band microwave device was prepared near the end of 1959 in the Hungarian Telecommunications Research Institute (Tavkozlesi Kutato Intezet). This equipment can transmit "a television program and 600 telephone conversations simultaneously." Noting that "considerable help was received from Soviet specialists," the article predicts expanded Soviet-Hungarian cooperation in the area of signal technology.

"The Hungarian Telecommunications Research Institute signed a contract, near the end of 1959, with a signal engineering research institute [sic] of the Ministry of Communications USSR. Under this contract, the two institutes will develop more modern, larger capacity, broader-band microwave equipment by 1963. The new equipment will also be suitable for transmission of television programs and simultaneous telephone conversation; but, due to its wider band it will be able to handle color television and 1,920 simultaneous telephone conversations."

50. Standardization of Radio Components

"To Standardize Components of Radioelectronic Equipment," by V. S. Kiskachi, State Committee for Defense Technology; Moscow, Standartizatsiya, No 2, Feb 59, pp 50-51

Engr V. S. Kiskachi in a letter to the editor of the periodical Standartizatsiya discloses shortcomings in standardization of electronic components and suggests some means for eliminating these shortcomings.

The lack of interchangeability of electrical components, as manufactured by different enterprises, is often due to nonuniformity in coupling devices. For instance, the seven- and nine-pin miniature tubes manufactured by the aviation industry have a 23-mm base coupling, while similar tubes manufactured by the radio industry have a 25-mm base coupling.

Such a lack of interchangeability hinders the repair of radio engineering equipment and makes procurement of spare parts difficult. In standardizing radio components, it would not be expedient to try to standardize all the radio components at once, but it would be sufficient at the beginning to standardize the most widely used components, such as contact and contactless selsyns, plugs and sockets, various switches, push-button devices, microswitches, variable and fixed resistors, relays, tube bases, tube sockets, signal lamps, etc.

The standardization of radio equipment should be under the direction of the State Committee for Radioelectronics and the Committee for Standards, Measures, and Measuring Instruments.

51. Double Helix Delay System in Traveling-Wave Tubes

"An Investigation of the Properties of Traveling-Wave Tubes With a Delay System in the Form of a Two-Helix Line," by A. V. Slutskaya; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics); Moscow-Leningrad, 1959, pp 3-22

The propagation of an electron beam in a two-helix line is considered within the framework of linear theory. The characteristic equation is derived for the determination of the propagation

constant of the waves in the system, and a graphical study is made of the equation which expresses the quantity of the built-up waves. A study is also made of the qualitative dependence of the amplification factor and band width on frequency, operating voltage, current, and radius of the electron beam, and also of the character of the wave and its phase constant during a change of operating voltage.

52. Coupling Coefficient of Backward-Wave Tube With Double Helix

"A Calculation of the Coupling Coefficient in a Backward-Wave Tube With a Double Helix," by Ye. B. Ol'derogge and L. N. Loshakov; Trudy Konferentsii po Elektronike SVCH (Reports of the Conference on Microwave Electronics); Moscow-Leningrad 1959, pp 23-34

Formulas are derived for computing the coupling coefficient during the interaction of an electron beam and the field of an arbitrary three-dimensional harmonic in a backward-wave tube with a double helix. A detailed study is made of the dependence of the coupling coefficient of the first backward harmonic on the geometry of the helix, the frequency and the dimensions of the beam.

53. Transverse Stubs as Delay System in Wave Guides

"A Delay System of Transverse Stubs in a Rectangular Wave Guide," by Ye. G. Solov'yev; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics); Moscow-Leningrad, 1959, pp 35-44

The theory of a delay system of transverse stubs in a rectangular wave guide is treated on the basis of the Maxwell equations. In addition to the formula for the coupling resistance, a transcendental equation is derived for the phase constant of two modes of oscillations, symmetrical and asymmetrical. The calculation is done on the basis of formulas for a particular case of wave-guide dimensions.

Since both symmetrical and asymmetrical oscillations can be sustained in such delay system, both "slow" waves ($v < c$) and "fast" waves ($v > c$) are possible. Fast waves and higher order waves can be eliminated by varying the stub dimensions. The walls of the wave guide have an influence on the phase velocity of the wave only if they are very close to the stub system. The coupling resistance of the first inverse three-dimensional harmonic increases toward the

short-wave range; that of the first forward three-dimensional harmonic increases with longer waves. The first inverse three-dimensional harmonic has the highest coupling resistance value.

54. Efficient Cathodes for Microwave Devices

"Modern Types of Cathodes for Microwave Devices and the Possible Ways of Producing New High-Efficiency Cathodes," by B. M. Tsarev; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics); Moscow-Leningrad, 1959, pp 236-260

Modern versions of thermoelectric cathodes are surveyed and classified according to their characteristics and operation in microwave devices, and the possibilities of improvement and the production of new types of thermocathodes, as well as the promise of using autoelectronic emitters in microwave devices, are discussed.

55. Multitier and Multiseries Stub Delay Systems

"An Analysis of Multitier and Multiseries Stub Delay Systems," by R. A. Silin; Trudy Konferentsii Po Elektronike SVCh (Reports of the Conference on Microwave Electronics); Moscow-Leningrad, 1959, pp 45-57

On the basis of the Leblond method (Leblond, A., and Mourier, G., Ann. Radioelectricite, Vol 9, No 36, 1954, pp 180-199; No 38, 1954, pp 311-328) and multiterminal-network theory (2(p + 1)), an investigation is made of certain multitier delay systems with multiple rotational symmetry. The Leblond method is also generalized for multiseries-multitier systems. Dispersion equations are derived; coupling resistance values are computed; and the voltage distribution is determined in relation to stub height.

56. Soviet KIU-1 20-Megawatt Pulsed Klystron

"A 20-Megawatt Pulsed Klystron Amplifier for the 10-Centimeter Range," by M. N. Afonskaya, V. G. Gabyshev, S. A. Dunayev, S. A. Zusmanovskiy, M. L. Lyubimov, A. G. Mishkin, and G. P. Shchelkunov, Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 58-79

This article contains a description, illustrations, and a discussion of the development of the Soviet KIU-1 klystron, which, although based on the 20-megawatt pulsed klystron developed at Stanford University (Proc. IRE, Vol 41, No 11, 1953, pp 1584-1602), required the solution of eight specific local problems for its development.

The characteristics of the KIU-1 klystron are given as follows:

Pulsed anode voltage	280-300 kilovolts
Pulsed anode current	170-180 amperes
Efficiency	About 40 percent
Amplification factor	About 1,500
Available pulsed power	20-25 megawatts

57. Electron Efficiency of Backward-Wave Tube

"The Electron Efficiency of a Type-M Backward-Wave Tube," by M. B. Tseytlin; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 261-270

The electron efficiency of a type-M backward-wave tube is determined according to the formula $\eta_э = 1 - p^2 \frac{U_л}{U_a}$, where $U_л$ is the beam potential, U_a is the potential of the retardation system, and p^2 is a constant depending on the trajectory of the electrons. It is assumed that all electrons are confined to the system. It is shown that $p = \frac{v_a}{v_o}$, where v_a is the velocity at which the electrons enter the system, and $v_o = \sqrt{\frac{2e}{m}\sqrt{U_л}}$ is the drift velocity of the electrons. It follows that the electrons in the interaction space move in curvilinear trajectories, v_a is greater than v_o and, consequently, p^2 is greater than unity. A calculation of the electron trajectories in a high-frequency field of a traveling wave for an infinitely thin beam in the vicinity of a space charge shows that, for all practical cases, p^2 is less than 1.10. Thus, in the case of an infinitely thin beam, the velocity v_a, with which the electron reaches the anode, is equal to the drift velocity v_o.

58. Czechs Experiment With Machine Translation of English Texts

"Automatic Machine as Translator" (CTK dispatch); Bratislava, Uj Szo, 15 Jan 60, p 5

"Philologists of the Czech language faculty of the Philosophy School of the Prague Charles University who are dealing with the theory of machine translation in the Prague Cybernetics Institute recently told representatives of the press about the success of the translation experiments done with the SAPO computer. In their discussions, held in the presence of Dr Frantisek Kahuda, Minister of Education and Cultural Affairs, they showed that the SAPO can translate simple English texts which have been fed into the automatic system with the aid of a punch card apparatus."

Another article on the same topic, published in the 14 January 1960 issue of Rude Pravo, principal Communist Party organ of Czechoslovakia, contains the same information but adds that philologists and mathematicians are cooperating in an effort to lay down some ground rules prior to working on special translation machines, since SAPO was not originally designed to be a translation machine. The article closes with the statement that Czechoslovak researchers in this field are availing themselves broadly of the assistance and experiences passed on to them by the Experimental Laboratory for Machine Translation at Leningrad University.

59. Czechoslovaks Planning New Electronic Computer

"Czechoslovak Automatic Computer SAPO" (unsigned article); Prague, Podnikova Organizace, 19 Nov 59, p 522

The article reviews the achievements of the existing Czechoslovak SAPO automatic computer and discusses its operation. It states that SAPO is a universal digital computer operating on the binary principle; it has about 8,000 relays and its circuit is composed of about 350 electron tubes. SAPO was suggested in 1951 and made of Czechoslovak parts.

Near the end of the article, the unidentified author contends that although SAPO is suitable for solving administrative and economic problems, it is only of limited use in major research problems, since it has a small memory capacity. One memory cell has a capacity for retaining only a 6-digit decimal number. However, the author points out in a footnote, solutions to complex problems, which would require a substantially greater speed of operation (about 1,000 times greater than SAPO), will be within the grasp of Czechoslovak researchers in the near future.

Requirements of complex problems will be met by a new type of electronic medium automatic computer (EPOS), suggested by the Research Institute of Mathematical Machines (Uyzkumny ustav matematickych stroju) and which is to be series produced in Czechoslovakia.

60. Hungarian and Soviet Work on Self-Reproducing Machines Discussed

"Relays, Nerve Cells, and Mathematical Logic" (unsigned article); Budapest, Nepszabadsag, 10 Dec 59, pp 6-7

The article reports on a conversation with M. A. Gavrilov, Doctor of Technical Sciences, a "department chief" in the Institute of Automatics and Telemechanics of the Academy of Sciences USSR, and a "well-known researcher in technical applications of mathematical logic"; V. P. Smiryagin, chief of the Operations Laboratory of the Computer Center of the Academy of Sciences USSR; and T. I. Milchenko and D. I. Golenko, workers at the Computer Center. All had been visiting in Hungary.

The article is a very general discussion of cybernetics in its theoretical and applied aspects. Specific statements are not attributed to any of the above men. General statements are made about the use, presumably in the Soviet Union, of control mechanisms which test, evaluate, and apply the best possible programs to the process being controlled. Development "throughout the world" of the theory of "relay networks" is mentioned.

CPYRGHT

"An interesting new trend in automatic control and computation techniques," the article continues, "is the preparation of special computers to design complex relay systems. One of the most modern machines for analyzing relay systems has been built in the Soviet Union and gratifying results have been achieved in the direction of creating a machine to synthesize relay systems. Similar work is being done in Hungary where Prof Laszlo Kalmar and his colleagues built the Szeged logic machine. The goal is to design machines with which the processes of designing control mechanisms can be automatized; thus, these machines automatically design machines like themselves."

61. Industrial Computers

"Electronic Computer Technology and Automation of Industry," by A. Shokin, First Vice-Chairman of State Committee of Council of Ministers USSR on Radioelectronics; Moscow, Pravda, 20 Oct 59, p 2

The EIS-1 has been identified as being employed in the petroleum industry for determining the character of petroleum bearing strata, rational distribution and exploitation of oil wells, etc.

Electronic computers may be employed to great effect in metallurgy. At present, the more perfect computer USM-1 is being prepared for use in these two areas of industry, as well as in construction work.

62. Rumanian Computer Conference

"Technical-Scientific Conference Dealing With Electronic Computers" (unsigned article); Bucharest, Scinteia Tineretului, 14 Jan 60, p 1

According to the source, a technical-scientific conference on electronic computers had its opening session on 13 January at the Academy of the Rumanian People's Republic. After the opening speech by Academician Grigore Moisil, the conference was addressed by foreign guests, including N. V. Korolkov (USSR), W. Kammerer (GDR), and L. Aczel (Hungary). Reports were presented by Rumanian scientists and engineers.

The conference, which lasted 3 days, discussed problems of the construction and theory of electronic computers numerical analysis, the theory of programming, and the application of computers in science, technology, economy, machine translation and in the management of enterprises.

63. New Chinese Computer

"Brief Communications" (unsigned article); Moscow, Izvestiya, 16 Sep 59, p 3

The first tests of a high-speed computer were successful in the Institute of Computer Technology of the Academia Sinica. The electronic computer performs operations at the rate of 10,000 per second.

Instruments and Equipment

64. Simplified Method for Analysis of Complex Electronic Circuits

"Analysis of Complex Electronic Circuits," by L. Ya. Nagornyy and V. P. Sigorskiy; Moscow, Radiotekhnika, No 12, Dec 59, pp 28-37

Circuits of great complexity are now being widely used in radio engineering and its numerous branches.

Obtaining analytical expressions for various values in such complex electronic circuits is a difficult problem, especially if such components as transistors and microwave vacuum tubes enter into the make-up of the circuit. The procedure for such computation can be considerably simplified if one utilizes the generalized method for obtaining terminal voltages and branch currents. It is convenient to apply conformal transformation of fractional linear functions in the final analysis of the dependence of circuit values on circuit parameters.

In most cases a complex electronic circuit can be represented in the form of a four-terminal network in which the power source is connected to the input terminals and the load to output terminals. This method is convenient for analysis of any linear circuit, especially a complex circuit incorporating both vacuum tubes and transistors, in which the parameters of the latter depend on frequency and are expressed by complex numbers.

65. Direct Observation of Antenna Radiation Patterns

"Instrument for Observing Antenna Radiation Patterns in Polar Coordinates," by V. O. Kobak; Moscow, Elektrosvyaz', No 12, Dec 59, pp 72-73

An instrument for observing the radiation patterns of short-wave and ultrashort-wave antennas is described. The instrument, which has been used successfully for several years, exhibits stable operation and simplicity of control.

The test antenna or model is excited by means of a transmitting antenna and oscillator having audio frequency modulation. The signal received by the test antenna during its rotation changes according to the radiation pattern, passing through a detector and amplifier to a phase-splitting circular scanning selsyn. The selsyn rotates synchronously with the test (receiving) antenna. Two voltages, modulated during rotation, are taken from the secondary windings of the selsyn and have a phase displacement of 90°. These voltages pass through the output amplifiers to the deflection plates of a cathode-ray tube having prolonged afterglow. Simultaneously, brightening pulses fall on the modulator of the tube. The frequency of tracking and pulse phase is precisely synchronized with the modulation frequency, thus brightening the tube only for positive amplitude values of the signal on the deflection plates. For each revolution of the antenna the spot traces its radiation pattern on the screen. The principle is generally the same as that used in circular scanning radar.

A brief description is given of the characteristics of the basic components of the instrument.

66. Reflection Coefficients of Ultrahigh Frequencies

"Techniques of Measurements of Reflection Coefficients in Free Space on Ultrahigh Frequencies," by D. I. Mirovitskiy, Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 103-108

Peculiarities of two basic types of devices -- with coupled and separated antennas -- are described. The methods of determination of reflection coefficients of dielectric specimens and possibilities of improving the accuracy of measurements are presented.

67. Measurements of Pulse Amplitude

"Measurement of the Amplitude of Pulses of Low Repetition Rate," by V. M. Lyubin and L. Makedonskiy; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 125-126

Equipment permitting the use of a dial instrument in measuring the amplitude of single and low-frequency periodic pulses is described. The equipment is intended for the study of secondary emission, photoconductivity, and other electric properties of dielectrics and semiconductors with high specific resistance.

68. Compensation Magnetometer

"Compensation Magnetometer With a Thermostated Hall Converter," by D. D. Voyeykov; Moscow, Pribory i Tekhnika Eksperimenta, No 4 Jul/Aug 59, pp 100-102

The diagram of a magnetic induction meter is described, based on the Hall effect. The device measures the fields of solenoids and permanent magnets within the range of 100-16,000 gauss with an accuracy of $\pm$ 1.5% + 1 gauss.

69. Air Filled Discharger

"Air Filled Discharger With Thermal Fuse," by V. G. Kalinin and L. V. Tarasova; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 90-93

The construction of an air filled discharger (thermotron) for commutation of strong currents at voltages of 3-10 kv with ignition by metal wire heated by an electric current is described. The characteristics of the discharger are analyzed.

70. Hungarian Physicists Get Japanese Electron Microscope

"The New Electron Microscope of the Technical Physics Research Institute Can 'See' One Millionth of a Millimeter" (unsigned article); Budapest Nepszabadsag, 5 Jan 60, p 7

The article tells about the electron microscope which the Technical Physics Research Institute (Muszaki Fizikai Kutato Intezet) of the Hungarian Academy of Sciences purchased from Japan. It will be used in materials fatigue studies, for quality control, etc. The article notes that in 1956 Hungary had only two electron microscopes, but that there are now three in the Technical Physics Research Institute and one in each of Hungary's four medical schools.

Materials

71. Theory of Magnetic Recording of Images

"On the Theory of the Visualization of Magnetic Recording," by V. G. Pamrunov; Moscow, Elektrosvyaz', No 12, Dec 59, pp 35-42

"An analysis is made of the forces acting on a particle of ferromagnetic powder by means of which visualization of magnetic recording is possible. Technological problems are discussed and materials used in visual recording and for obtaining prints on paper are examined."

72. Semiconductors for Thermocouples to Be Used at High Temperatures

"High-Temperature Semiconductor Thermocouples," by P. S. Kislyy and G. V. Samsonov, Institute of Powder Metallurgy, Cermets, and Special Alloys, Academy of Sciences Ukrainian SSR; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk -- Metallurgiya i Toplivo, No 6, Nov/Dec 59, pp 133-137

The purpose of the work described was development of thermocouple elements (electrodes) consisting of high-melting compounds which in some cases must exhibit a high degree of chemical stability. It was established that a number of alloys of high-temperature semiconductor compounds of the boron carbide or chromium silicide type with metal-like compounds, such as carbides and borides, exhibit high values of the EMF and a linear dependence of the EMF in the temperature range from 300-400 to 2,000-2,200°C. These compounds and alloys have a high resistance to aggressive media. They can be used for high-temperature semiconductor thermocouples.

A high-temperature thermocouple has been developed which consists of molybdenum disilcide and graphite treated with boron. This thermocouple has an EMF which increases linearly from 4 to 45 millivolts in the temperature range of 400-2000°C. It is distinguished by a constancy of the EMF in time and can be used in oxidizing media at temperatures of 1,800-1,900°C.

A number of thermacouples were developed which consist of graphite treated with boron and carbides or borides of titanium, zirconium, and other high-melting metals. These thermocouples are to be used for measuring temperatures in vacuum, reducing media, and inert atmospheres within a range up to 2200-2300°C. They exhibit linear scale characteristics of the EMF, which changes from 5-6 to 90-120 millivolts in the range from 300-400 to 2,200-2,300°C.

On the basis of the results obtained, it is concluded that there are no practical limitations to the selection of suitable materials and the construction of high-temperature semiconductor thermocouples from them with a sufficient EMF, adequate sensitivity, and sufficient stability for any applications which may be required.

It was found that silicon nitride has an excellent resistance to the action of molten metals and is therefore suitable as a material for sheathes protecting thermocouples used to measure the temperature of metals in the molten state. Silicon nitride does not form good junctions with boron-treated graphite, however, and for this reason cannot be used as an outer tubular electrode in thermocouples of this type.

73. Work on Nuclear Energy, Semiconductors, and Refractory Alloys at Institutes of Academy of Sciences Ukrainian SSSR

"Science and Technical Progress," by I. M. Fedorchenko, Corresponding Member and Chief Scientific Secretary of Presidium of Academy of Sciences Ukrainian SSR; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 11, Nov 59, pp 58-64

"Ukrainian scientists who participate actively in theoretical research in the field of nuclear physics are working on problems pertaining to the utilization of the energy of fission of the heavy nuclei of uranium, plutonium, and other elements, the energy of fusion of light nuclei, and the solution of problems involved in controlled thermonuclear reactions, which is a foremost task that must be accomplished by present-day physics. Our scientists active in the Ukrainian SSR are engaged in the design of new types of nuclear reactors, the development of new and efficient heat-transfer agents for nuclear power plants, and the design of new heat-transfer equipment. They are continuing the investigation of ways for increasing the output of nuclear plants generating power and of applying automatic methods in the operation of these plants.

"The scientists at the academy institutes and other scientific institutions of the Ukrainian SSR are faced with the task of expediting investigations in the field of semiconductors, both with the purpose of solving theoretical problems in this field and of developing and improving the technology of the production of new semiconductor materials suitable for use within a wide range of temperatures.

"Continued technical progress is impossible without the creation of new materials which exhibit a high mechanical strength combined with a low weight, resistance to high temperatures, resistance against corrosion and wear, and special magnetic and electrical characteristics.

"Important tasks in connection with this must be solved by the teams of scientific workers active at the Institute of Powder Metallurgy, Cermets, and Special Alloys; Institute of Metal Physics; and Physicotechnical Institute of the academy. One must, first of all, develop a theory of the fundamental processes of powder metallurgy and create new materials suitable for application in contacts and as magnetic and ferrite materials. Materials which have special properties from the standpoint of their application in electrical engineering, as new materials for cathodes of vacuum tubes, as semiconductors, as heat-resistant and superhard alloys, and as friction and antifriction materials must also be developed.

"Particular attention must be paid to powder metallurgy and the introduction of metal ceramics into practical use.

"The 7-year plan of activities at the Academy of Sciences Ukrainian SSR foresees further ramification and growth of the network of scientific institutions, as well as the creation of new institutes and laboratories. It is planned to open 18 new institutes, including those of Semiconductors, Radioengineering Problems, Colloidal Chemistry, Biophysics, Ore Deposits, Geophysics, Turbines, and Rare Metals. A Physicomathematical Institute will also be organized."

74. Semiconductor Properties of Selenium Tetrabromide

"The Electrical Properties of Selenium Tetrabromide," by V. N. Romankevich and V. G. Sidyakin, Leningrad State Pedagogic Institute imeni A. I. Gertsen; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy -- Fizika, No 4, Jul 59, pp 19-20

The dependence of the electrical conductivity and the thermal EMF of $SeBr_4$ on the temperature was determined. The results obtained indicate that $SeBr_4$ has semiconductor properties. The work described has a bearing on research done by the authors relative to the effect of halogens on the semiconductor properties of selenium.

75. Semiconductor Research

"Semiconductor Laboratory at the University," by P. Yerno-Volzhskiy; Moscow, Radio, No 10, Oct 59, p 16

Extensive research in the field of semiconductors is now being carried out at the Semiconductor Laboratory of the Leningrad State University imeni A. A. Zhdanov. The laboratory cooperates in its studies with the State Optical Institute, the Scientific Research Institute Imeni A. S. Popov, and others. The workers of the institute, under the direction of R. Ya. Berlaga, are now conducting research on photoelectric and optical properties of semiconductors. These investigations are designed to disclose some useful properties of semiconductors that might find practical application.

The laboratory also conducts an extensive training program; about 200 students are now working here on their theses.

76. Measuring of Resistance of Semiconductors

Measuring of Resistance and Potential of the Surface of Layers of a Semiconductor," by V. M Lyubin; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 118-122

A method for measuring resistance and the surface potential of high ohmic semiconducting layers is described. It is based on irradiation of the surface of the layers by two electron beams. The method permits the study of kinetics of processes of charge and discharge of the surface of the semiconductor. The method is intended for investigation of photoconductivity and cathode conductivity in semiconducting layers, used in television transmitting tubes.

77. Measuring of Capacity of p-n Junctions

"Pulse Method of Measuring the Capacity of p-n Junctions," by S. G. Shulman, Institute of Semiconductors, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 122-126

A method for measuring the capacity of p-n junctions is suggested under a pulse shift, based on the principle of compensation of transient processes. The results of measurements carried out on collector junctions of series P6 triodes are presented.

78. Charge of Electrets

"Methods of Measuring the Charge of Electrets," by A. N. Gubkin, V. S. Mitronina, V. F. Sergiyenko, and M. I. Subbotin, Physics Institute, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 113-118.

Methods for measuring the charge of electrets are discussed and devices are described permitting the measuring with sufficient accuracy of the surface density of the electret charge.

79. Luminescent Afterglow of ZnS

"Photoelectret State and Luminescent Afterglow in ZnS," by V. M Fridkin, Institute of Crystallography, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR Vol 129, No 4, Dec 59, pp 773-776

The behavior of photoelectrets, analogs of an excited luminescent crystal, is analyzed. It is assumed that N, the concentration of electrons on localized adherence levels, equals P, the concentration of holes, and both numbers are proportional to the total light sum and to the charge of photoelectrets. A parallel study was carried out of the photoelectret state and luminescent afterglow in a polycrystalline ZnS activated by Cu and Cl. Three groups of adherent levels were found. The deepest levels are responsible for the formation of a stable photoelectret state in the dielectric. The second group conditions the dark polarization of the dielectric which drops faster than photopolarization. The third group, the most superficial, is responsible for luminescent afterglow.

[For additional information on materials, see Chemistry, Inorganic Chemistry.]

80. Theory of Radio-Thermal Direction Finder

"Theory of a Radio-Thermal Direction Finder With Conical Scanning," by Yu. V. Pavlev; Moscow, Radiotekhnika, No 12, Dec 59, pp 50-57

The problem of finding the direction of weak radio-thermal sources with continuous spectrum has been of great interest during the past few years. The sources of such signals are the extraterrestial radiation (sun, moon, radio stars) and radio-thermal radiation of on-ground objects. The modulation-type radio-thermal direction finders used for detection of such signals incorporate the following units: a sensitive radiometer, square-law detector, narrow-band low-frequency amplifier, and low-frequency filter.

Expressions for limiting and angular sensitivity of a modulation-type radio-thermal direction finder with conical scanning are derived. A formula for equivalent temperature of the antenna is found, which is applicable for different values of the noise factor.

Wave Propagation

81. Brillouin Beam in Uniform Magnetic Field

"A Cylindrical Electron Beam in a Uniform Magnetic Field," by V. T. Ovcharov; Trudy Konferentsii Po Elektronike SVCh (Reports of the Conference On Microwave Electronics), Moscow-Leningrad, 1959, pp 80-89

Since the study of a cylindrical beam in a uniform magnetic field directed parallel to the axis of the beam made by Wang (Proc.IRE, Vol 38, 1950, pp 135-147) did not explain all the conditions under which such a beam can be sustained and did not explain all the properties of such a beam, this article uses an earlier explained method (Doklady AN SSSR, Vol 107, No 1, 1956, pp 45-50; Radiotekhnika i Elektronika, Vol 2, No 6, 1957) to show that a cylindrical beam in a longitudinal uniform magnetic field may be sustained under conditions more general than those given in the literature. A description is given of the distribution of potential within such a beam, and it is shown that the potential along the beam changes periodically. This distribution of potential outside the beam is also determined, and the conditions are explained under which such a

beam may be sustained. It is shown that when the longitudinal electrical field at the source of the beam is equal to zero and a certain longitudinal velocity of the electrons is reached, the periodic variations of potential disappear, and a beam results which has been explained in the literature as the so-called Brillouin beam.

82. Boundary Structure and Focusing of Hollow Electron Beam

"On the Problem of Focusing a Hollow Cylindrical Electron Beam in a Periodic Magnetic Field," by I. Sh. Kozel'; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 90-94

A solution is given of the problem of focusing a hollow electron beam in a periodic magnetic field. The connection is established between the admissible waviness of the internal and external boundaries of the beam and the inclination of the focusing. The peculiarities and optimal conditions of such a focusing are also discussed.

83. Periodic Magnetic Field in Focusing of Traveling-Wave Tube

"Traveling-Wave Tube Focusing Systems With a Periodic Magnetic Field," by V. B. Stepanishchev, A. A. Bryukhov, and Yu. P. Myakin'kov; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 95-102

An approximation method is given for calculating a focusing system with a periodic magnetic field for a traveling-wave tube, and a comparison is made between computed and experimentally obtained curves for the distribution of intensity of the magnetic field along the axis of the system. The results of experiments on the focusing, and parameters of a traveling-wave tube for radio relay links, are also given. It is shown that the use of a periodic magnet affords a considerable reduction of weight of the amplifier for the traveling-wave tube. A number of difficulties connected with the use of periodic magnets for the focusing of electron beams are mentioned.

84. Simplified Method of Computing Focusing of Electron Beams

"The Formation of Long Electron Beams by Means of Periodic Axially Symmetrical Electrostatic Fields," by Yu. D. Samorodov; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 103-111.

A simplified method is given for computing a periodic electrostatic focusing of electron beams. The conditions of the passage and configuration of the beam are determined in relation to various system parameters, and results are given of an experiment on the mechanism of focusing. The simplified theory gives a qualitatively accurate description of a periodic electrostatic focusing of beams within wide ranges of electrical and geometrical parameters. It is shown by experiment that, in systems with diaphragms, it is possible to obtain almost complete passage of a beam to the collector, even when the two focusing voltages are varied within rather wide ranges, or when the mean velocity of the beam is varied considerably, which is important in an electronic change-over of operating frequencies. The influences of the beam current, system spacing, and input conditions on the zone of current passage are indicated.

85. Weak Signal Propagation in Electron Beam With Varying Velocity Distribution

"Electron Waves in a Periodic Electrostatic Field and Their Interaction With the Field of Wave Guide Systems," by V. A. Solntsev and A. S. Tager; Trudy Konferentsii po Elektronike SVCh (Works of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 112-132

This article examines the propagation of a weak high-frequency signal in an electron beam with periodically changing electron velocity along the beam. The propagated current harmonics are studied and the conditions are established for a build-up of their amplitude during a movement of the beam in free space. The theory of weak signals is applied in the study of the interaction of the current harmonics and the natural waves of a smooth wave guide system having a phase velocity both less than and greater than the velocity of light.

88. Device for Plotting Trajectories of Charged Particles

"A Device for the Automatic Calculation and Plotting of the Trajectories of Charged Particles in Electronic and Magnetic Fields in the Presence of a Space Charge," by I. M. Bleyvas; Trudy Konferentsii po Elektronike SVCh (Works of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 133-149

A description is given of a new automatic recording device which computes and plots the trajectories of charged particles in electrical and magnetic fields in modern superhigh-frequency vacuum installations, and also plots the force lines and equipotential lines of an electrical field.

The trajectories of the particles are computed in a Cartesian system of coordinates, with the influence of a space charge and the relativistic correction taken into account. The electrical field is simulated in an electrolytic bath. The computing arrangement of the apparatus is based on the use of direct-current electronic integrators in conjunctions with electronic nonlinear blocks. The average time of calculating one trajectory is 2-3 minutes. The trajectories are computed with an error of 1-2 percent, and the force lines and equipotential lines are computed with an error of one percent.

87. Electromagnetic Wave Propagation in Helical Delay System Within Dielectric Medium

"The Propagation of Electromagnetic Waves in Delay Systems Using a Helix and Dielectric," by B. M. Bulgakov and V. P. Shestopalov; Trudy Konferentsii po Elektronike SVCh (Works of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 150-170

A study is made of the propagation of electromagnetic waves in a helix installed in a dielectric medium in the presence of an electron beam. The properties of the delay system are considered under the assumption that design changes are possible for both the helix and the dielectric. With increased dielectric permittivity of the medium in which the helix is placed, the amplification of the system, in the case of a constant wave length, decreases somewhat and is accompanied by an increase of the velocity of the electron beam (for which amplification is still possible), while at the same time the efficiency of the system fluctuates only insignificantly.

If a particular wave length of the amplified oscillations is selected, the amplification factor of the system, electron beam-helix-dielectric, may be greater than that of the system, electron beam-helix.

The introduction of additional elements into the delay system (axial) metallic rods, external metallic housing, etc.) affords the possibility of varying the dispersion of the system.

The use of magnetic materials in the delay system, together with the dielectric, leads to a considerable over distribution of flow of the electromagnetic energy propagated within the system.

88. Multiple Line With Rectangular Conductors

"The Calculation of a Multiple Line With Conductors of Rectangular Cross Section," by I. Sh. Beluga; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 171-186

A multiple line with rectangular conductors in a single series is considered for the case where the length of the gap between neighboring conductors exceeds several times the width of a single gap, and the following are given: a precise expression for the wave conductivity and approximate formulas for the amplitude of 2 three-dimensional harmonics with maximum phase velocities, for cases where the width of the interaction space is greater than the period.

Certain considerations are introduced regarding the applicability of the formulas as approximate formulas in the case of small values of the above gap relationship.

The calculation is done by conformal mapping. In contrast to the calculation of Fletcher (Proc. IRE, Vol 40, No 8, 1952), the heterogeneity of the field in the gaps is taken into account. It is shown that Fletcher's formulas for the wave conductivity can give an error of up to 100 percent.

89. Simplified Graphic Method of Computing Filter Losses

"Computation-Graphic Method of Determining the Losses of Three-Section Symmetrical Microwave Filters," by B. Ye. Rubinshteyn; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 187-201

Since a determination of the general dependences of the loss function of microwave filters on their parameters ordinarily requires a considerable amount of mathematical treatment, this article proposes a graphic method which, to a certain degree, diminishes and simplifies the

calculations of filter losses. An analysis of the loss function according to extremal points shows that the required dependence may, in many cases, be obtained without a detailed calculation of all the loss curves.

90. Space Charge, Electrode Configuration, and Phase Aberration in Reflex Klystron

"On the Electronics of the Reflex Klystron," by D. M. Petrov; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 202-225

An investigation was made of a klystron subjected to extraneous effects (klystron not self-excited) at low amplitudes. A comparison of the results of a calculation of the electron conductivity with those determined by experiment shows a considerable discrepancy between the theory of an idealized klystron and experimental data (Waters, W. E., "Space Charge Effects in Klystrons," IRE Transactions on Electron Devices, Vol ED-4, No 1, Jan 57).

The results are given here of a theoretical analysis of the effects of space charge, surface curvature of the electrodes, and phase aberration on the electronics of a reflex klystron. A modification of the theory of the idealized klystron through the introduction of corrections involving the above factors leads to a satisfactory agreement of calculated and experimental data. This article also gives comparative results of an experimental study and theoretical calculations of the steady oscillations of a reflex klystron.

91. Interaction of Electrons and Periodic High-Frequency Field in Carcinotron

"A Cascade Bunching of Electrons as Applied to the Analysis of the Carcinotron," by V. N. Shevchik and Yu. D. Zharkov; Trudy Konferentsii po Elektronike SVCh (Reports of the Conference on Microwave Electronics), Moscow-Leningrad, 1959, pp 226-235

An approximate kinematic theory is proposed for the interaction of electrons with a high-frequency field of periodic structure. Formulas are derived for expressing the intensity of the interaction and the actuating current of a backward-wave tube, allowing all three-dimensional harmonics to be taken into account.

92. Calculation of Maximum Usable Frequencies

"Evaluation of Calculation Methods for Finding Maximum Usable Frequencies," by E. M. Gaspar'yants; Moscow, Electrosvyaz', No 11, Nov 59, pp 17-23

The following methods for determination of maximum usable frequencies were studied in regard to their accuracy: the K. M. Kosikov method, the Central Radio Wave Propagation Laboratory (CRPL, USA) method, the method of "equal hops," and the high-frequency characteristics calculation method utilizing "transmission curves."

The experimental data was obtained on 1,500-7,00-km radio-communication lines. Measurements included field intensity and beam inclination to the vertical plane. The investigation revealed that the most precise methods for any distance of radio-wave propagation was the method of "equal hops" and the method of calculation by high-frequency characteristics. Comparison of calculated values with the observed values permits evaluating the required correction for each method examined.

93. New Method for Determination of Ground Conductivity

"Determination of Ground Conductivity by Measuring Wave Attenuation," by V. Ye. Kashprovskiy; Moscow, Radiotekhnika, No 12, Dec 59, pp 8-14

The success of long-range radio communication depends on the knowledge of ground parameters for the territory over which the wave travels, especially that of the ground conductivity.

After a series of experiments and tests carried out by the author at the Scientific Research Institute of Terrestial Magnetism, the Ionosphere, and Radio Wave Propagation (NIZMIR), a simple and field-proven method based on measurement of the rate of decrease in wave-field intensity when an indicator is lowered to various depths below the earth's surface has been developed. For this experiment a modified commercial model radio receiver "Turist" was used. The data secured by this method reflects the actual condition of the ground in the vicinity of the place of measurement and is not affected by interferences due to inhomogeneities of ground structure or composition.

94. Progress in Compiling Ground Electroconductivity Map of USSR

"The Electroconductivity Map Will Materialize," by V. Kashprovskiy; Moscow, Radio, No 12, Dec 59, pp 6-7

A considerable amount of material on ground electroconductivity in the USSR has now been accumulated at the Institute of Terrestrial Magnetism, the Ionosphere, and Radio Wave Propagation of the Academy of Sciences USSR. The institute is now processing these data and will use them for plotting a ground electroconductivity map of the USSR.

The following territories have been explored in some detail thus far: Northern Caucasus; a territory bounded by lines through Orenburg, Magnitogorsk, Chelyabinsk, Sverdlovsk, Perm', Kazan', Ul'yanovsk, Ufa, and Kuybyshev; the Central region in the vicinity of Serpukhov, Chekhov, Podol'skaya, Kalinin, Kostroma, and Yaroslavl'; the region of Vologda; the shores of the Rybinsk reservoir; the region of Novosibirsk; and the territory around Rostov-on-Don.

A further extensive survey over vast territory must be carried out before sufficient material will be accumulated to complete a comprehensive map of ground electroconductivity of the USSR.

95. Computing Maximum Temperature of Metal in Gas Turbine Combustion Chamber

"A Method of Calculating the Maximum Temperature of the Inner Jacket of a Gas-Turbine Combustion Chamber," by E. G. Narezhnyy, Leningrad; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Energetika i Avtomatika, No 5, 1959, pp 182-185

Although experimental and theoretical studies of the heat exchange in combustion chambers and the formulation of methods of calculating the temperature of the walls have repeatedly been reported in the literature, because of the complexity of the processes in the chamber and of the difficulties involved in setting up experiments, no work has been reported with quantitative results sufficient for an accurate estimate of the temperature of the metal in the chamber.

Certain results of an experiment on the heat exchange in the combustion chamber of a gas turbine installation were given in an earlier work by the author (Sudostroyeniye, No 10, 1957), wherein all experimental data refer to a combustion chamber with a vortex of cooling air, i.e., with a division of air flows into primary and secondary flows by means of a special arrangement of the aerodynamics of the chamber. Having a high ratio of actual-to-theoretical combustion, such a chamber, from the point of view of the operating conditions of the metal, has the advantage that only the radiational heat flow of the flame falls on the wall at the same time that an elimination of heat takes place as a result of the vortical air flow which, apparently, considerably increases the coefficient of heat emission.

This work gives the results of a processing of earlier obtained experimental data, and recommends a method of calculating the heat exchange and maximum temperature of the walls of a combustion chamber with a vortex of cooling air.

96. Bending Strength of End-Loaded Sandwich Plates

"On the Calculation of the Bending Strength of the Outer Layers of Curvilinear Sandwich Plates Subjected to Longitudinal Compression," by L. M. Kurshin; Voprosy Rascheta Elementov Aviatsionnykh Konstruktsiy, Sbornik Statey No 1, Raschet Trekhsloynykh Paneley i Obolochek, Moscow, 1959, pp 80-84

Formulas are derived for computing the longitudinal loading of curvilinear sandwich plates, with the intrinsic bending strength of the outer layers taken into account. The area of applicability where the intrinsic bending strength can be assumed to be equal to zero is also established.

97. Strength of Sandwich Panels With Phenoplast Filler

"Strength Tests On Sandwich Panels With Phenoplast Fillers," by A. Ya. Aleksandrov and L. E. Bryukker; Voprosy Rascheta Elementov Aviatsionnykh Konstruktsiy, Sbornik Statey No 1, Raschet Trekhsloynykh Paneley i Obolochek, Moscow, 1959, pp 3-13

To check established methods of calculation, an experimental investigation was made of the strength (under longitudinal compression) of three-layer plywood panels with lightweight fillers of phenoplasts. Flat and cylindrical panels with reinforced and unreinforced type FK phenoplasts were used in the tests.

98. Bonding Strength of Plywood Fillers

"Calculation of the Filler of Sandwich Plates, With Separation Taken Into Account," by A. Ya. Aleksandrov; Voprosy Rascheta Elementov Aviatsionnykh Konstruktsiy, Sbornik Statey No 1, Raschet Trekhsloynykh Paneliy i Obolochek, Moscow, 1959, pp 14-38

A description is given of a method of computing the strength of lightweight fillers for three-layer plywood plates, taking into account the sheer stress and separation originating at the interfaces between the filler and the outer layers. Formulas are derived for plates subjected to longitudinal compression and longitudinal-transverse bending.

99. Larger Deflections of Sandwich Cylindrical Shells

"The Larger Deflections of Sandwich Cylindrical Shells," by L. M. Kurshin; Voprosy Rascheta Elementov Aviatsionnykh Konstruktsiy, Sbornik Statey No 1, Raschet Trekhsloynykh Paneley i Obolochek, Moscow, 1959, pp 39-50

A variation method is used to obtain a system of nonlinear equations for finite deflections of sandwich shells. In accordance with nonlinear theory, the problem is solved for longitudinal compression of sandwich

cylinders freely supported on four edges. The results of the solution indicate that the decrease of load capacity following loss of stability is less for sandwich shells with lightweight fillers than for single-layer shells of the same thickness.

100. Stability of Curved Panels With Corrugated Sandwich Filler

"The Stability Under Compression of Cylindrical Freely Supported Sandwich Panels and of a Cylinder With a Corrugated Filler," by L. M. Kurshin; Voprosy Rascheta Elementov Aviatsionnykh Konstruktsiy, Sbornik Statey No 1, Raschet Trekhsloynykh Paneley i Obolochek, Moscow, 1959, pp 51-68

Stability equations are derived for a cylindrical sandwich shell consisting of two thin outer layers and a middle layer of corrugated form. The stability problem is solved for curvilinear sandwich plates freely supported on four edges and of a cylinder under compression loading.

101. Stability of Side-Loaded Curved Sandwich Plates

"Stability Under Compression of a Curvilinear Cylindrical Sandwich Plate With Fastened Transverse Edges and Freely Supported Longitudinal Edges," by L. M. Kurshin; Voprosy Rascheta Elementov Aviatsionnykh Konstruktsiy, Sbornik Statey No 1, Raschet Trekhsloynykh Paneley i Obolochek, Moscow, 1959 pp 69-79

A solution is given to the problem of the stability of sandwich cylinders with lightweight isotropic filler under a uniform longitudinal compression for the case when the transverse edges are fastened and the longitudinal edges are freely supported.

102. Buckling of Circular Cylindrical Shell Reinforced With Elastic Ribs

"The Twisting and Bending of a Circular Cylindrical Shell Reinforced With Elastic Ribs," by S. I. Galkin; Voprosy Rascheta Elementov Aviatsionnykh Konstruktskiy, Sbornik Statey No 1, Raschet Trekhsloynykh Paneley i Obolochek, Moscow, 1959, pp 102-141

An investigation is made of the stress condition of a circular cylindrical shell reinforced by elastic ribs and edge-loaded by an arbitrary system of axial and tangential forces. Formulas are given for computing all the components of elastic deformation for various boundary conditions

along the edges. An investigation is also made of the influence of self-balancing forces on the stress condition of the shell in relation to the rigidity of the ribs. It is shown that the self-balancing forces do not attenuate very extensively; they are distributed through practically the entire cross section of the shell.

103. Torsion of Open Cylindrical Shells

"The Torsion of Open Cylindrical Shells Reinforced by Ribs," by S. I. Galkin; Voprosy Rascheta Elementov Aviatsionnykh Konstruktsiy, Sbornik Statey No 1, Raschet Trekhsloynykh Paneley i Obolochek, Moscow, 1959, pp 85-101

The solution of the problem of the torsion of open cylindrical shells reinforced by ribs is obtained without the introduction of any supplementary hypotheses, except for the general assumptions connected with the representation of the strain in open shells as momentless. On the basis of this solution, the limits are described for the applicability of the hypothesis of "deplanation" (absence of sheer in median planes), which has been widely used in problems of computing open shells subjected to torsion.

104. Temperature Distribution in I-Shape Wing Element

"Calculation of Nonstationary Temperatures in an I-Shape Element," by N. I. Nazorov, M. S. Povarnitsyn, and Ye. V. Yurlova; Voprosy Rascheta Elementov Aviatsionnykh Konstruktskiy, Sbornik Statey No 1, Raschet Trekhsloynykh Paneley i Obolochek, (Problems of the Design of Elements of Aviation Subassembles, Collection of Articles, No 1, Calculation of Sandwich Plates and Shells) Moscow, 1959, pp 142-168

The temperature field of an I-shape element (typical section of a multispar wing is computed by two methods, the method of direct integration of the equations of thermal conductivity and the method of elementary balances. Cases of symmetrical and nonsymmetrical heating of such elements through the outer surface of the flanges and cases of various thicknesses of the spar flanges are considered. The solution of the problem is given under the assumption that the physical characteristics of the material and the coefficients of heat transfer do not depend on temperature change.

105. Electrical Properties of Silicone Liquids

"Investigation of Electrical Properties of Certain Silicone Liquids," by B. N. Dolgov, N. P. Kharitonov, and Yu. I. Khudobin, Institute of Silicate Chemistry, Academy of Sciences USSR; and V. T. Renne and G. P. Soya, Leningrad Polytechnic Institute; Minsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Energetika, No 11, Nov 59, pp 59-66

The article describes the investigation of certain silicone liquids synthesized at the Institute of Silicate Chemistry and tested at the Leningrad Polytechnic Institute.

The silicone compounds examined were designated as No 2, 243 and 529. All these silicones have a high boiling point and low melting point which makes them suitable for application as liquid insulators. The electrical properties for the silicones No 2, 243, and 529 were respectively as follows: permittivity at 50 cycles -- 3.18, 3.49, and 3.29; loss-angle tangent at 50 cycles--$9 \cdot 10^{-4}$, $8 \cdot 10^{-4}$, $1 \cdot 10^{-4}$; at 1 kc--$4 \cdot 10^{-4}$, $4 \cdot 10^{-4}$, $5 \cdot 10^{-4}$; at 0.2 Mc--$6 \cdot 10^{-4}$, $3 \cdot 10^{-4}$, $6 \cdot 10^{-4}$; and resistivity--$3 \cdot 10^{13}$, $4 \cdot 10^{13}$, $4 \cdot 10^{13}$ ohm cm. Breakdown voltage was 11.4 kv/mm for No 2 and 14.9 kv/mm for No 529.

The effect of temperature on the electrical properties of these silicones was studied in detail.

106. New Fabricating Technique of Welded Shafts for Very Large Hydrogenerators

"Investigation of Steel and Technology of Fabricating Welded Shafts for Very Large Hydrogenerators," by A. S. Gel'man, I. R. Kryanin, V. V. Levando, and V. K. Novitskiy; Leningrad, Energomashinostroyeniye, No 12, Dec 59, pp 33-37

During the designing of turbines for the Volzhskaya and Bratskaya hydroelectric power stations, the Leningrad Metals Plant has developed two variants for fabricating welded shafts. The Central Scientific Research Institute of Technology and Machine Building, in cooperation with the Khar'kov Turbogenerator Plant, the Novo-Kramatorskiy Heavy Machinery Plant, and the Institute for Electric Welding imeni Paton have conducted extensive research on materials and the fabricating technology of welded shafts.

Two fabricating variants were studied: a seamless shaft cylinder forged from a hollow billet with two cast-steel flanges subsequently welded to its ends, and a shaft cylinder welded from two semicylindrical bent plates with two cast steel flanges subsequently welded to its ends. The cast-steel flanges were made of grade 20GSL steel (C-0,16 to 0.22%, Mn - 1.0 to 1.3%, Si - 0.6 to 0.8 %) and the shaft cylinder was made of open-hearth grade 20GS steel (C - 0.18%, Mn - 1.28%, Si - 0.78%). The forged cylindrical portion of the shaft (less flanges) weighed 18.56 tons and was made of a 36.2-ton billet. Electroslag welding technique was used in fabricating these shafts.

It was concluded that a shaft fabricated from a seamless shaft cylinder was preferable to the one fabricated with two welded semicylindrical sections.

107. Formula for Porous Concrete

"Large Wall Panels From Porous Concrete" (unsigned article); Moscow, Stroitel', No 12, Dec 59, pp 6-7, 10-11

At the Tagilstroy Trust large porous-concrete wall panels are fabricated from the following mixture (for 1 cu m of concrete): grade 400 Portland cement, 130 kg; ground granulated cinder (slag), 720 kg; unslaked lime, 85 kg; semidry granulated cinder (slag), 420 kg; common salt, 8 kg; calcium chloride, 8 kg; aluminum powder, 0.5 kg.

After mixing with water and drying, the porous concrete acquires compressive strength of 100-200 kg/cm^2 and specific weight of 1,300-1,400 kg/m^3.

108. Diamond Instrument Plant Construction in Kabardino-Balkarskaya ASSR

"Instruments From Diamonds," by L. Bekhterev; Moscow, Izvestiya, 3 Feb 60, p 2

The first diamond instruments are scheduled to be produced within 6-7 months at the specialized plant being rushed to completion in the settlement of Terek, a regional center of the Kabardino-Balkarskaya ASSR. Diamonds will be supplied from Yakutiya.

109. First All-Union Convention of Inventors

"To Intensify the Struggle for Technical Progress," by V. V. Grishin, All-Union Central Council of Trade Unions; Moscow, Izobretatel' i Ratsionalizator, No 11, Nov 59, pp 4-8

The article, which gives an account of the First Convention of the All-Union Society of Inventors and Innovators, 22-24 September 1959, contains the following passages:

"The primary organizations of the Society of Inventors and Innovators exist only at the largest enterprises. At the conference it was reported that the society has only 35,000 primary organizations, yet in the country there are 200,000 enterprises, 100,000 construction projects, and several thousand institutions and schools. For example, at the Moscow plant "Kauchuk" with its 1,000 men there are 250 innovators, but at each of the several mines of the "Rostovugol'" and "Luganskugol'" there are only one or two innovators.

"Poor organization of the invention and innovation movement is observed not only in the coal industry, but in the lumber industry, in agriculture, and at construction projects as well. The trade union organizations, and especially various public organizations, should give serious consideration to this problem and should initiate necessary measures to arouse the workers to creative efforts in all fields of the national economy."

VI. MATHEMATICS

110. Information Theoretic Proof of Central Limit Theorem

"An Information Theoretic Proof of the Central Limit Theorem Based on the Lindeberg Conditions," by Yu. V. Linnik; Moscow, Teoriya Veroyatostey i yeye Primeneniya, Vol 4, No 3, Jul-Sep 59, pp 311-321

The proof is based on the "information functional" $-\int_{-\infty}^{+\infty} p(x) \ln p(x)\, dx + \frac{1}{2} \ln D(x)]$, $p(x)$ being taken as the density of a random variable X. Some new relations between the Shannon and Fisher information quantities are established and an information theoretic interpretation of the Lindeberg conditions is presented.

111. Spectral Theory for Abstract Functions

"Special Analysis of Abstract Functions," by Yu. A. Rosanov; Moscow, Teoriya Veryatnostey i yeye Primeneniya, Vol 4, No 3, Jul-Sep 59, pp 291-310

A spectral theory is developed for abstract functions similar to the well-known theory for stationary random processes.

112. Maximum Deviation Distributions in Bernoulli Scheme

"Asymptotical Analysis of Maximum Deviation Distributions in the Bernoulli Scheme," by V. S. Korolyuk; Moscow, Teoriya Veroyatnostey i Yeye Primeneniya, Vol 4, No 4, Oct-Dec 59, pp 369-397

Methods are related for constructing asymptotic expansions for the maximum deviation distribution in the Bernoulli scheme and in its limiting case, the Poisson scheme. The paper contains a review of results on the asymptoticity of distributions of the maximum deviations between a theoretical and an empirical distribution function, and between two empirical distribution functions.

113. Wave Guide With Random Heterogeneities on Lobachevsky Plane Studied

"Wave Guide With Random Heterogeneities and Brownian Movement on the Lobachevsky Plane," by M. Ye. Gertsenshteyn and V. B. Vasil'yev; Moscow, Teoriya Veroyatnostey i yeye Primeneniya, Vol 4, No 4, Oct-Dec 59, pp 424-432

It was shown that the probability density for the continuous random process of the resultant of independent values, "summed up" according to the fractional linear law, satisfies the diffusion equation of the Lobachevsky plane. Green's function of the diffusion equation, apparently a new distribution, was derived.

114. Composition of Distributions in Lobachevsky Space

"Limit Theorems for the Composition of Distributions in the Plane and Space of Lobachevsky" F. I. Karpelevich, V. N. Tutubalin, and M. G. Shur; Moscow, Teoriya Veroyatnostey i yeye Primeneniya, Vol 4, No 4, Oct-Dec 59, pp 432-436

Some physical problems require the study of random variables (or measures) on the Lobachevsky plane (space) L.

A Borel measure $\mu(\Gamma)$ is symmetrical for any rotation h around the origin of coordinates O, and if $\mu(h\Gamma) = \mu(\Gamma)$ for any Borel measurable set Γ. The composition $\mu_1 * \mu_2(\Gamma)$ of the symmetrical measures $\mu_1(\Gamma)$ and $\mu_2(\Gamma)$ is defined by the equation

$$\mu_1 * \mu_2(\Gamma) = \int_L \mu_1(\Theta_x^{-1}\Gamma)\,\mu_2(dx),$$

where Θ_x denotes any motion in L which transforms O into x, $\mu_1 * \mu_2(\Gamma)$ being equal to $\mu_2 * \mu_1(\Gamma)$.

The concept of a characteristic function is introduced for symmetrical measures. The characteristic functions of two measures are multiplied to get the characteristic function for the composition of these measures.

There is a system of normal measures in the association of Borel probability measures. If the set of symmetrical measures $\mu_{n,r} (n \geq 1, 1 \leq r \leq k_n)$ satisfies conditions analogous to the Lindeberg-Feller conditions, the sequence of measures

$$\xi_n = \mu_{n,1} * \cdots * \mu_{n,k_n}$$

converges to a normal measure.

115. Fourier Transformations of Entire Functions

"On the Fourier Transformations of Entire Functions of Several Complex Variables," by F. S. Aliyev; Baku, Izvestiya Akademii Nauk Azerbaydzhanskoy SSR, seriya Fiziko-Matematicheskikh i Tekhnicheskikh Nauk, No 5, Sep/Oct 59, pp 13-20

In the work by I. M. Gel'fand and G. Ye Shilov, "Fourier Transformations of Rapidly Increasing Functions and Questions of Uniqueness of the Cauchy Problem" Usp. Matem. Nauk, Volume 8, No 6, 1953, it is proved that the Fourier transformation of an entire function of a complex variable of the exponential type is concentrated (in the general sense) on the complex envelope of singularities of the function associated with the initial entire function according to Borel.

The purpose of the present work is to describe the set on which the Fourier transformation of an entire function of several complex variables is concentrated with a finite type growth of the first order.

A general construction for the Fourier transformation of a function with a given region of concentration is considered.

Let $f_1(z_1) = \sum a_n z_1^n$ be an entire function of the exponential type, the Fourier transformations of which are concentrated in the bounded region A. Further let $f_2(z_2) = \sum b_n z_2^n$ be an entire function of the exponential type, the Fourier transformation of which is concentrated in the bounded region B. The following theorem is then proved:

The Fourier transformation of the function $\Phi(z_1, z_2) = f_1(z_1) : f_2(z_2)$ as a function of the two complex variables is concentrated on the set C which is the monologic product of the sets A and B.

116. Cauchy Problem for Infinite System of Linear Partial Differential Equations

"Concerning the Cauchy Problem for an Infinite System of Linear Partial Differential Equations in the Class of Generalized Functions," by N. M. Suleymanov; Baku, Izvestiya Akademii Nauk Azerbaydzhanskoy SSR, seriya Fiziko-Matematicheskikh i Tekhnicheskikh Nauk, No 5, Sep/Oct 59, pp 21-35

As is known, the Cauchy problem for an infinite system of linear partial differential equations in a class (ordinary) of functions sufficiently smooth and bounded together with their derivatives up to a definite order was investigated by Z. I. Khalilov, DAN SSSR, Volume 8, No 2, 1952.

This problem was thoroughly investigated in a class of generalized functions for any finite system of linear partial differential equations by I. M. Gel'fand and G. Ye. Shilov, Usp. matem. nauk Volume 8, No 6, 1953 and Obobshchennyye funktsii (Generalized Functions) No 1-3, 1959; V. M. Borok, Matem. sb. Volume 36, No 2, 1955; and by A. G. Kostyuchenko and G. Ye. Shilov, Usp. matem. nauk, Volume 9, No 3, 1954.

The purpose of the present work is the application of the above-listed results to the investigation of the solution of the Cauchy problem for infinite systems in the class of generalized functions.

117. Covergence Theorems for Iterative Methods Discussed

"On the Convergence Theory of Iteration Methods," by S. Ul'm, Tallin Polytechnic Institute; Tallin, Izvestiya Akademii Nauk Estonskoy SSR, Seriya Tekhnicheskikh i Fiziko-Matematicheskikh Nauk, Vol 8, No 3, Jul- Sep 59, pp 153-165

Theorems concerning the convergence of iteration methods may be classified according to two types:

1. Theorems in which convergence of the considered method is proved together with existence and uniqueness of the equation's solution.

In the case of the method of Newton (for the approximate solution of nonlinear operator equations), the first of such theorems was proved by L. V. Kantorovich (Uspekhi matem. nauk, Vol 3, No 6(28), 1948, pp 89-185). He later generalized and made his theorem more exact employing the principle of majorants (L. V. Kantorovich, Dokl. AN SSSR, Vol 76, No 1 1951, pp 17-20, and Vestn. Leningr. un-ta, No 7, 1957, pp 68-103). A series of authors proved analogous theorems concerning convergence of several other methods (M. A. Mertvetsova, Dokl. AN SSSR, Vol 88, No 4, 1953, pp 611-614; M. I. Nechepurenko, Uspekhi matem. nauk, Vol 9, No 2(66), 1954, pp 163-170; and S. Yu. Ul'm, Uch. zap. Tartusk. un-ta, No 42, 1956, pp 135-142). More general methods for the proof of such theorems were given by Yu. Ya. Kaazik, Uspekhi matem. nauk, Vol 12, No 1(73), 1957, pp 195-199 and E. E. Tamme, Izv. vyssh. uchebn. zavedeniy, matematika, No 5(6), 1958, pp 115-121.

2. Theorems in which the existence of solutions is presupposed and only conditions for convergence of the considered method are given (frequently characterized by the uniqueness of the solution).

Several of such theorems for real equations and systems of equations (ordinary method of iteration and the method of Newton) have been proved by various authors (I. P. Mysovskikh, Prikl. matem. i mekhan., Vol 16, No 6, 1952, pp 756-759; L. Ford, Amer. Math. Monthly, Vol 23, No 6, 1925, pp 272-287; A. Ostrowski, Matem. cb., Vol 3(45), No 2, 1958, pp 254-258 and Comment. Math. Helvetici, Vol 9, 1936, pp 79-103; and P. Romanowsky, Z. angew. Math. und Mech., Vol 9, No 5, 1929, pp 420-421), and for nonlinear operator equations (method of Newton) by I. P. Mysovskikh (Dokl. AN SSSR, Vol 70, No 4, 1950, pp 565-568, and Vestn. Leningr. un-ta, No 11, 1953, pp 25-48) and by B. A. Bertgeym (Nauchn. tr. Molotovsk. gorn un-ta, No 1, 1956, pp 142-153, and Uspekhi matem. nauk, Vol 12, No 1(73), 1957, pp 166-169).

The theorems of the second type are more difficult to apply than theorems of the first type since knowledge concerning the region of distribution (spheres) of the solution is required. On the other hand, they often give the possibility to extend the conditions of convergence of the iteration methods and also to make more exact the estimates of the errors.

The present work is devoted to prove theorems of the second type by utilization of the principle of majorants for several iteration methods often applied in practice. It is proved that majorant equations may be constructed for broader conditions than for theorems of the first type.

118. Integro-Differential Equations

"Concerning One Method of Solving Singular Integro-differential Equations," by N. P. Vekua, Academy of Sciences Georgian SSR, Tbilisi Mathematical Institute; Tbilisi, Soobshcheniya Akademii Nauk Gruzinskoy SSR, Vol 23, No 2, Aug 59, pp 129-134

The generalization of the method of A. I. Nekrasov was shown applicable to a system of singular integro-differential equations of the form

$$A(t_o)\frac{d\rho(t_o)}{dt_o} + B(t_o)\rho(t_o) + \frac{1}{\pi i}\int_L \frac{K(t_o, t)\rho(t)\,dt + \Gamma(t_o, t)\frac{d\rho(t)}{dt}}{t - t_o}\,dt = f(t_o),$$

where L is an interrupted smooth contour on the plane $z = x + iy$; $A(t_o)$, $B(t_o)$, $K(t_o, t)$, and $\Gamma(t_o, t)$ are quadratic matricies of order n, given on the contour L satisfying the condition H of Gel'der, $f(t_o) = (f_1, f_2, \ldots, f_n)$ is a vector also given satisfying the condition H and $\rho(t_o) = (\rho_1, \rho_2, \ldots, \rho_n)$ is the vector sought for.

It was assumed that the vector $\frac{d\rho(t)}{dt}$ satisfies the condition H everywhere on L, while at terminal points and close to terminal points it may belong to class H* (N. I. Muskhelishvili, Singulyarnyye integral'nyye uravneniy (Singular Integral Equations), Gostekhizdat, Moscow/Leningrad, 1946).

119. Functions of Class $W_2^1(\alpha)$ Studied

"Boundary Properties of Functions of Class $W_2^1(\alpha)$ and Their Application to the Solution of One Boundary Value Problem of Mathematical Physics," by A. A. Vasharin; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Matematicheskaya, Vol 23, No 3 May/Jun 59, pp 421-454

The boundary properties of functions of class $W_2^1(\alpha)$, defined on a certain bounded region Ω are investigated.

Questions concerning continuation of the functions from the boundary are also considered.

120. Integrability and Convergence of Expansion for Operator of Schroedinger Studied

"Differentiation of Expansions According to Eigenfunctions of the Two-dimensional Operator of Schroedinger," by I. S. Sargsyan, Institute of Mathematics and Mechanics, Academy of Sciences Armenian SSR; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Matematicheskaya, Vol 23, No 3, May/Jun 59, pp 455-488

Asymptotic estimates for the derivatives of the spectral function of the Schroedinger operator are investigated in a finite or infinite portion of the two-dimensional space. The asymptotic estimates obtained for the derivatives of the spectral function are used in a study of integrability and convergence of the differentiated expansion in terms of eigenfunctions for the Schroedinger operator. The method and theorems of B. M. Levitan [illegible] the Fourier integrals are the fundamental auxiliary means.

121. Approximation by Entire Functions

"Approximation on the Exterior of a Segment and Half-Line by Entire Functions," by Yu. A. Brudnyy; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Matematicheskaya, Vol 23, No 4, Jul/Aug 59, pp 595-612

The theory of approximation for functions with a given continuity modulus with the help of entire functions of finite degree is discussed.

122. Asymptotic Estimates for Solutions of Systems of Differential Equations

"Derivation of Several Asymptotic Estimates for the Solutions of Differential Equations Having a Small Parameter in the Derivatives," by Ye. F. Mishchenko and L. S. Pontryagin; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Matematicheskaya, Vol 23, No 5, Sep/Oct 59, pp 643-660

Asymptotic formulas for solutions of systems of differential equations having a small parameter in the derivatives within a neighborhood of "disruption points" are derived.

VII. MEDICINE

Bacteriology

123. Chinese Devise Microtechnique for Rapid Bacterial Identification

"A Microtechnique for Rapid Determination of Bacteria by Their Biochemical Reactions," by Tseng Fan-chi (曾 凡 济), Wuhan Army General Hospital; Reiping, Jen-min Pao-chien (People's Health), Vol 1, No 12, 1959, pp 1123-1125

The author presents a method for the rapid identification of bacteria by their biochemical reactions. The procedure applies to ordinary culture media and reagents in minute amounts. The protocol reportedly was devised by the author and colleagues after repeated experiments.

Details of comparative experiments conducted to test the accuracy of the microtechnique are given. In these experiments, the microtechnique was run in parallel with the conventional macrotechnique in the determination of at least 55 different species of bacteria, including Salmonellae, Shigellae, Bacteria aerogenes, Proteus vulgaris, Escherichiae, Klebsiellae, Bacillus fecalis alkaligenes, Bacillus pyocyaneus, Diplococcus pneumoniae, Staphylococci, and Streptococci. Results were identical for each pair of parallel test, but were obtained much sooner by the microtechnique. For example, the time required to determine pathogenic enterobacteria was only 20-24 hours as compared with the usual 4-5 days.

The author reports that he and his colleagues had previously experimented with the paper disc method introduced in 1957 by A. C. Sanders and others. But they were not satisfied with Sanders' method because its application was limited to enterobacteria. Since July 1959, the microtechnique described in the present paper has been used widely and satisfactorily as a clinical diagnostic test and has been adopted by other "fraternal units" [military medical units?], he says.

124. Chinese Research on Microtechnique for Diagnosis of Typhoid and Paratyphoid Fevers

"Studies on the Hemolytic Reaction of Pathogenic Enterobacteria and the Feasibility of Its Application in Microserologic Diagnosis. I. The Hemolytic Reaction of Erythrocytes Sensitized With O Antigens of Pathogenic Enterobacteria," by Wu K'ai-yu (吴 开 予) and Wang Jui-fang (王 瑞 芳), Fukien Institute of Epidemiology; Peiping, Chung-hua Nei-k'o Tsa-chih (Chinese Journal of Internal Medicine), Vol 7, No 8, Aug 59, pp 728-731

This paper describes a "new" microtechnique for the early serodiagnosis of enteric fevers. Details of controlled experiments conducted to compare the test with other diagnostic procedures are also presented. The authors say that the new test is specific and much, more sensitive than the ordinary agglutination and hemagglutination tests. It applies the hemolytic reaction of sheep erythrocytes which have been sensitized with O antigens of pathogenic enterobacteria. For their experiments, the authors prepared O antigens from strains of Salmonella typhi, Sal. paratyphi, Shigella flexneri, Sh. sonnei, and Escherichia coli group lll, all of which were obtained from the Culture Museum of their research institute.

In preparing the materials for each test, an antigen suspension containing 2 billion bacteria per milliliter was made by washing off 18-24 hour agar slants, and the suspension was centrifuged after boiling. Then washed sheep erythrocytes were added to the supernatant in a 1:9 ratio and the mixture was agitated for 2 hours in a 37° C water bath for complete sensitization. All test sera were inactivated and treated to remove hemolysins naturally present. The complement source was also treated with sheep erythrocytes to absorb hemolysins.

The test was performed with controls in a set of ten to fifteen 12-75-millimeter tubes each containing 0.2 milliliter of the test serum in serial dilution (beginning with 1:160). To each dilution, 0.2 ml of a 5% concentration of sensitized sheep erythrocytes and an equal amount of complement in a 1:20 dilution are added. The test tubes are then incubated at 37° C and the hemolytic unit is read after 2 hours.

On the basis of experimental results, and taking into consideration cross hemolysis which occurs at low titers (1:320) within some groups of pathogenic enterobacteria, the authors consider a hemolytic test positive only if the hemolytic titer is higher than 1:640. They report that specific hemolysis has appeared in typhoid cases as early as 3 days after the onset of illness.

"Studies on the Hemolytic Reaction of Pathogenic Enterobacteria and the Feasibility of Its Application in Microserologic Diagnosis II. Feasibility of Applying the Microtechnique of Hemolysis in the Diagnosis of Typhoid and Paratyphoid Fevers," by Wu K'ai-yu and Wang Jui-fang, Fukien Institute of Epidemiology; Peiping, Chung-hua Nei-k'o Tsa-chih (Chinese Journal of Internal Medicine), Vol 9, No 7, 13 Sep 59, pp 905-907

This article reports that blood specimens of 33 patients suspected of typhoid or paratyphoid fever were used in comparative studies with the Widal test and the microtechnique of hemolysis (described in the preceding article). O and H antigens and A and B paratyphoid antigens were used respectively to sensitize sheep erythrocytes. The authors present results to show that for typhoid and paratyphoid cases the microtechnique is 4-32 times more sensitive and gives 6 percent more positives than the Widal test.

The article also reports details of comparative studies in which capillary blood and venous blood from the same patient were used in parallel tests by the microtechnique. Results showed identical hemolytic titers, indicating that capillary blood and venous blood have the same antibody concentration. The authors conclude that as little as 0.01 ml of capillary blood is sufficient for the microtechnique. Experimental results corroborated their earlier conclusion that a hemolytic titer of over 1:640 is of diagnostic significance.

The authors note that the experiments reported in this paper were performed in 1958.

Epidemiology

125. Special Measures for Persons Working in Tick-Borne Encephalitis Foci

"Experience in the Prevention of Infection With Tick-Borne Encephalitis," by A. I. Punishko; Moscow, Geodesiya i Kartografiya, No 12, Dec 59, pp 54-57

This article reports special instructions given to topographic detachment No 217, which has been working in tick-borne encephalitis foci in the Far East for a number of years. Since no vaccine existed during the first years, according to this report, it was resolved to employ

simple, available means of preventing encephalitis and to prepare the members of this detachment to protect themselves. A series of lectures on the subject "Tick-Borne Encephalitis, Its Pathogen, and Measures of Controlling It" was presented to all engineering and technical workers before they went into the field. Protective clothing, repellants (dimethylphthalate and "repudin"), and DDT and hexachlorane dusts and smoke pots were supplied to all workers going into the taiga.

Two protective garments, one for winter and one for summer, are illustrated and are described in the text. Instructions for applying the repellants to the face, hands, and garments are given. Measures for reducing perspiration odors, which attract ticks, are also suggested. Proper use of the other agents mentioned above is described. The importance of mutual vigilance and inspection is emphasized.

During field work, antiencephalitis serum (and dimedrol for the prevention of serum sickness) was administered to workers on whom sucking ticks were observed. The serum was administered by feldshers attached to the detachments during the period of greatest tick activity. In case of the necessity for hospitalization, all therapeutic institutions were informed that a detachment was working in the vicinity.

Through the efforts of party and trade union organizations, the workers of the detachment were made to realize the importance of active control of encephalitis; as a result, the article states, no cases of the disease were reported among these workers in 1958 and 1959. It is recommended that field work be curtailed to the maximum extent during the period of greatest tick activity (May, June, July), resumed at the end of July, and continued into the mild autumn characteristic for the Far East.

Immunology and Therapy

126. Cancer Therapy

"What Is New in Cancer Therapy" (unsigned article); Moscow, Krasnaya Zvezda, 6 Jan 60, p 4

Prof L. M. Shabod, acting director of the Institute of Experimental and Clinical Oncology of the Academy of Medical Sciences USSR, in reply to a question as to what is new in the fight against cancer submitted by a Krasnaya Zvezda correspondent, said that during 1959 new advances have been made in the effort to control the disease. Several methods of

cancer therapy have been developed by Soviet scientists: surgery, radiotherapy with Roentgen rays and other sources of irradiation, combined surgery and irradiation, chemotherapy with such drugs as dopan and sarcolysin, and hormone therapy. Scientists of the Laboratory of the Chemistry of Natural Substances under G. P. Menshikov isolated a crystalline substance from the bark of the oleaster which has been found to be hightly effective against tumors. This substance is now being recommended for clinical application, after numerous experiments have been successfully carried out on animals. An oncological institute in which all methods of cancer therapy will be utilized is being constructed in Moscow.

127. Soviet Cancer Medicines

"Soviet Cancer Medicines" (unsigned article); Budapest, Magyar Nemzet, 7 Jan 60, p 6

The article reports that Soviet professors Larionov and Berlin developed "Shartsolyzin" and "Dopan"; these two medicines will be manufactured in 1960. Professor Menyshikov directed the preparation of a crystalline substance, also effective against cancer, from so-called "sand thorn roots." This substance is now being tested in clinics. The Soviet Institute of Oncology is also experimenting with "anticancer antibiotics" and with combined surgical and radiation treatment methods.

128. Chinese Use Atropine to Reduce Toxic Reaction to Antimonials in Treatment of Schistosomiasis

"Preliminary Observation on the Application of Atropine to Prevent Vomiting and Lessen Toxic Reactions to Antimonials in Treatment of Schistosomiasis," by P'eng Ssu-ch'en (彭 斯 臣), Han-ch'uan Hsien Schistosomiasis Control Station, and Liu Chu-ho (刘 珠 荷) and Yang Ssu-jun (楊 嗣 潤), Wuhan Medical College Work Team for Eradication of Pests and Disease in Han-ch'uan Hsien; Peiping, Chung-hua Nei-k'o Tsa-chih (Chinese Journal of Internal Medicine), Vol 7, No 7, 13 Jul 59, pp 680-681

The authors point out that antimonial preparations used in the treatment of schistosomiasis caused severe vomiting in 40-87 percent of cases reported in the literature and that the reaction is most often the reason for discontinuing treatment. They report complete success in the use of atropine to prevent vomiting in an experimental group of 34 cases

of schistosomiasis receiving antimonial therapy. Among the control group of 35 patients who received the antimonial preparation without atropine, 15 reacted by vomiting. In the experimental group, other toxin reactions such as headache, dizziness, nausea, and continuous, hard coughing occurred to a much lesser extent than in the control group.

The authors state that their preliminary observations, which were conducted in late 1958 and early 1959, ended when members of their group had to return to Wuhan Medical College. Their report is published for the reference of those who expect to make further studies on the subject.

129. Hungarian Conference Shows Bloc Work With Phagocytes, Immunology

"International Histological Macrophage Symposium," by Imre Toro; Budapest Magyar Tudomany, Nov 59, pp 602-604

This report concerns a conference held in Budapest in September 1959. An introductory paper reviews the history of research on phagocytosis and immunobiological processes and states that most of the papers read at the conference would deal with the reticuloendothelial system.

Fischer of Berlin reported on the importance of the placenta in immunobiological processes; analyzing the important problem of the permeability of cell walls, he pointed out many important phenomena even in intrauterine life.

Ludany of Budapest and Vultskhanov of Sofia dealt with the problem of stimulating or hindering phagocytosis in the case of white blood cells or microphages. They showed how various substances, medicines, vitamins, hormones, and nervous system activity affect the functioning of phagocytes. They showed that the reticuloendothelial system produces substances (opsonin, bacteriotropin) which increase the phagocyte activity of white blood cells. Decreasing the activity of this system decreases the production of immuno-substances.

Professor Pischinger of Vienna dealt with the problem of blood macrophages, as did Professor Hadzhiolov of Sofia.

One of the most debated problems was that of the tissue macrophages or histiocytes. Godina, Torino, and Toro dealt with this problem. From their work it was seen under certain circumstances the common tissue cells, the fibroblasts, can take the form of histiocytes, showing the same phagocyte properties as the macrophages. Films shown also illustrated the mechanisms of phagocytosis and pinocytosis.

Professor Stanek of Bratislava examined the phagocytic ability of the gliacytes of the central nervous system, pointing out those phenomena which differ and those which are similar as compared with histiocytes.

Rohlich of Budapest dealt with the problem of macrophages of the peripheral nervous system.

Professor Jancso reported on a new and useful procedure for observing factors which influence phagocytosis.

Muller of Budapest reported on the feeding of unicellular organisms. It developed that a single unicellular organism cannot digest every type of desoxyribonucleic acid (DNA); this shows the structural differences of this acid of various origins and also shows that the unique enzymes of the cells have a significant role in that not every cell is able to participate equally in phagocytosis of certain materials.

The histological symposium will be held in Bratislava in 1960 and in Lausanne in 1961.

Oncology

130. Reliable Method for Detecting 3,4-Benzpyrene in Liquid Nitrogen by Fluorescence Spectrum

"The Use of the Fine Structure of the 3,4-Benzpyrene Fluorescence Spectrum to Increase the Reliability of Its Detection," by P. P. Dikun, Laboratory of Experimental Oncology, Institute of Oncology, Academy of Medical Sciences USSR; Moscow, Voprosy Onkologii, Vol 5, No 12, Dec 59, pp 672-677

In this report the author describes a very accurate method according to which the presence of 3,4-benzpyrene (a very strong carcinogenic hydrocarbon) can be identified in various products such as polluted atmospheric air, coal tar, cigarette smoke, the unsaponifiable fractions derived from smoked fish, smoked sausage, and lungs of city dwellers.

The method consists of dissolving polycyclic aromatic hydrocarbons in normal paraffin (n-hexane, n-octane, etc.) and freezing the solutions in liquid nitrogen. Then the fluorescence spectra of the solutions is

photographed. When this is done, very fine lines appear in the fluorescence spectra of these solutions. The wave lengths of these lines can be measured as accurately as the wave lengths of lines in atomic spectral analysis.

Data obtained are presented in the form of tables in which 3,4-benzpyrene is identified from similar but not necessarily carcinogenic hydrocarbons such as 1,12-benzperylene; 1,2,5,6-dibenzanthracene, 3,4,6,7-dibenzpyrene; 1,2-benzanthracene; 3,4,8,9-dibenzpyrene; and pyrene.

Results of these experiments show that because of the delicate structure of the fluorescence spectra of 3,4-benzpyrene and the other polycyclic aromatic hydrocarbons, these compounds can be identified in various products with great accuracy. The reliability of identifying them by this method is significantly greater than by the presently existing methods. Also, the results of this research show that the hydrocarbon present in the products of smoking, smoked fish, smoked sausages, lungs of city dwellers, polluted atmospheric air, and coal tar is 3,4-benzpyrene and not any other compound similar to it.

131. Hungarian Histologists Link Thymus and Tumors

"Interesting Experiments at the Histology Institute" (unsigned article); Budapest Magyar Nemzet, 6 Jan 60, p 5

This report on work being done at the Hungarian Histology and Embryology Institute (Szovet es Fejlodestani Intezet) under the direction of Kossuth Prize-winning Academician Imre Toro deals largely with the extensive work done there on thymus gland function. Dr Gyorgy Csaba, Candidate of Medical Sciences, explained to the reporter the role of the thymus in the human organism. He stated in part: "Our experiences show that the thymus gland may have a role in connection with the development of tumors.... In our isotope laboratory we examined the metabolism of the thymus; we conducted electron microscope examinations of the morphology of thymus cells; and we conducted histochemical examinations of materials from single cells. We have done numerous animal experiments in which we observed the transformation of thymus cells into other types of cells in certain disease states. These were the experiments which called our attention to the connection between this organ and tumors...."

132. Benzohexonium -- Ganglioblocking Drug

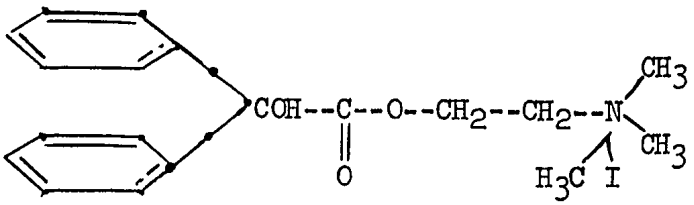
"Benzohexonium (Hexonium B)," by K. D. Sedova; Moscow, Annotatsii o Lekarstvennykh Sredstvakh (Notes on Medicinal Preparations), No IX, 1959, pp 9-11

Benzohexonium (1,6-hexamethylene-bis-(trimethyl ammonium), $(CH_3)_3N(CH_2)_6N(CH_3)_3 \cdot 2C_6H_5SO_3$) is a colorless crystalline substance readily soluble in water and hot alcohol, and poorly soluble in cold alcohol. It is insoluble in benzene and ether. Aqueous solutions of the drug give a neutral reaction. Pharmacological investigations established the ganglioblocking properties of benzohexonium. It inhibited the transmission of nervous impulses in the sympathetic and parasympathetic ganglia and reduced blood pressure in healthy rabbits and in rabbits with induced hypertonia. It is indicated in disorders requiring the regulation of the nervous system, in hypertonia, peripheral vascular spasms, and as a ganglioblocking drug in surgery. It can be administered intramuscularly or subcutaneously in the form of a 2-percent solution. Its administration is contraindicated in cases of hepatic and renal insufficiency and the sclerosis of cerebral and coronary vessels.

133. Metacin -- Cholinolytic Drug

"Metacin," by K. D. Sedova; Moscow, Annotatsii o Lekarstvennykh Sredstvakh (Notes on Medicinal Preparations), No IX, 1959, pp 49-51

Metacin is the iodomethylate of the dimethylaminoethyl ester of benzilic acid (diphenyl-oxyacetic acid). Its structural formula is as follows:

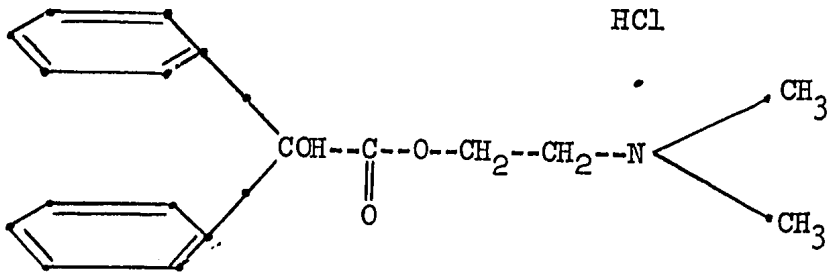


Metacin is a white crystalline powder soluble in boiling water. Its melting temperature is 192-195 degrees. Pharmacological studies have established that metacin has a strong cholinolytic action. Its action is manifested mainly in relation to peripheral, muscular-cholinoreactive and neurocholinoreactive systems of the parasympathetic ganglia. It may be subcutaneously, intravenously, and internally administered.

134. Benzacine -- Antispasmodic Drug

"Benzacine," by K. D. Sedova; Moscow, Annotatsii o Lekarstvennykh Sredstvakh (Notes on Medicinal Preparations), No 9, 1959, pp 7-8

Benzacine is the hydrochloride of the dimethylaminoethyl ester of benzilic acid. Its structural formula is as follows:

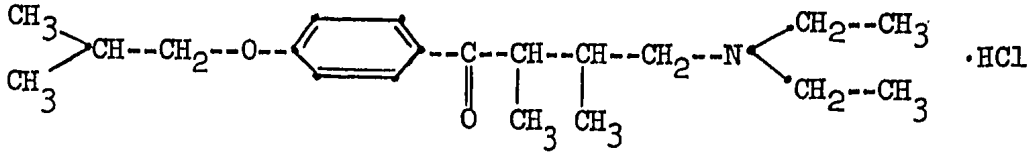


Benzacine is a white crystalline powder, readily soluble in water. Its melting point is 184-186 degrees. Pharmacological studies revealed that it has an atropinelike action, although its action is not as pronounced. The cholinolytic action of benzacine is strongly manifested in intestinal spasms induced by acetylcholine or carbocholine. It is recommended for use as a spasmolytic in spasms of the smooth muscles of the internal organs. Benzacine is to be administered subcutaneously in doses of 0.5-1.0 milliliter of a 0.1-percent solution, or internally in doses of 0.001-0.002 grams two or three times a day. Side effects are an increase in the pulse rate, dryness in the mouth, dilation of the pupils, and a sense of weakness in the extremities. These are, however, of brief duration.

135. Gangleron -- Nicotinolytic Drug

"Gangleron," by K. D. Sedova: Moscow, Annotatsii o Lekarstvennykh Sredstvahk (Notes on Medicinal Preparations), No IX, 1959, pp 14-16

Gangleron is the hydrochloride of the alpha, beta-dimethyl-gamma-diethylaminopropyl ester of p-isobutoxy-benzoic acid. Its structural formula is as follows:

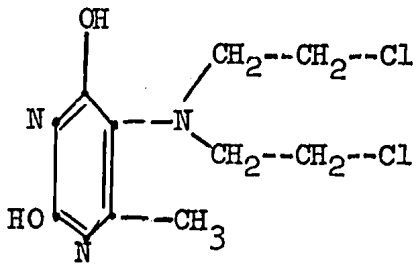


Gangleron was synthesized at the Institute of Fine Organic Chemistry of the Academy of Sciences Armenian SSR. It is in the form of colorless hygroscopic crystals which are readily soluble in water. Pharmacological studies established that gangleron has a strong nicotinolytic action, reduces the spasmodic effect of nicotine, and increases the resistance of experimental animals to the effect of the latter. It is recommended for the therapy of angina pectoris and chronic coronary insufficiency. Gangleron may be administered either subcutaneously or intramuscularly in doses of 2-4 milliliters of 1.5-percent aqueous solution.

136. Dopan -- Chemotherapeutic Drug in Therapy of Leukemia

"Dopan," by K. D. Sedova; Moscow, Annotatsii o Lekarstvennykh Sredstvakh (Notes on Medicinal Preparations), No IX, 1959, pp 30-34

Dopan chemically is 4-methyl-5-di-(2-chlorethyl)-aminouracil. Its structural formula is as follows:



Dopan is a white crystalline powder, odorless, and with a bitter taste. It is almost insoluble in water and dissolves with difficulty in alcohol. Experimental tests have established that dopan may be used instead of novembiquine in the therapy of myeloid leukemia. The advantage of dopan over the latter is that it is tolerated better by the patients. It cannot, however, fully replace novembiquine in the therapy of lymphogranulomatosis.

137. Effect of Thorium Dioxide on the Organism

"Lesions Which Develop in Man Under the Influence of Thorotrast Introduced Into the Organism," by L. Fryuling and A. Bettsenshlager, Usloviya Zhizni i Zhoroviye (Conditions of Life and Health), 1958, 1, No 4, 276-279 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 20, 20 Oct 59, Abstract No 27736, by the author)

"The introduction of thorotrast (thorium dioxide) into the human organism causes the development of 'thorotrast' disease with lesions which, in the author's opinion, are the result of alpha irradiation by thorium. The lesions are either of a necrotic character or are manifested by the atypical reproduction of cells and may lead to the development of malignant tumors (angioplastic endothelial sarcoma)."

138. Hungarian Medicine for Respiratory Center of Brain

"New Medicine -- Spiractin" (unsigned article); Budapest, Nepszabadsag, 7 Jan 60, p 6

The article announces the marketing of "Spiractin," a Hungarian medicine which can be used "to regulate respiratory disturbances arising as a result of various insults to the respiratory center of the brain, such as electric shock or luminal or morphine poisoning." It was developed by the workers of the Experimental Medical Sciences Research Institute (Kiserleti Orvostudomanyi Kutato Intezet) of the Hungarian Academy of Sciences under the direction of Karoly Nador. The article concludes by saying that "there is great interest abroad" in this medicine.

139. Effect of Gravitation on Movement Studied in Elevator

"Coordination of the Position and Movements of Man Under Conditions of Increased and Decreased Gravitation," by V. S. Garfunkel', P. K. Isakov, V. B. Malkin, and V. I. Popov, Institute of Experimental Biology and Medicine of Siberian Department of Academey of Sciences USSR; Moscow, Bulleten' Eksperimental'noy Biologii i Meditsiny, Vol 24, No 11, Nov 59, pp 12-18

This article reports experiments conducted in the elevator of Moscow State University to determine the coordination of the position and movements of people under alternating conditions, i.e., the short-term effect of overload and weightlessness. The operation of the elevator provided gravitational changes of 0.3-2.0 g within 2-3 seconds. It was observed that alternations of increased and decreased gravitation cause neither significant disturbances in coordinated movements of the entire body and its parts, nor any inadequacy in motor reactions. Analysis of the equilibrium reactions of the entire body and parts of the body, with the eyes open and closed, revealed that the role of the visual analysor in these reactions is not noticeably increased during the state of partial weightlessness. The data obtained leads to the conclusion that the system which regulates position and movements, based on proprioceptive afferentation, is not affected to any great extent.

The experiments were conducted on seven healthy people, four of whom were conducting the experiments.

140. Effect of Oxygen on Conditioned Reflexes

"Peculiarities of Development and Changes in Conditioned Reflexes When Oxygen Is Breathed at an Increased Pressure," by G. V. Altukhov and N. A. Agadzhanyan; Moscow, Zhurnal Vysshey Nervnoy Deyatel'nosti, Vol 9, No 6, Nov/Dec 59, pp 865-871

According to this article, the results of experiments on six dogs shows that there is a direct relationship between the formation of and disturbance in conditioned reflexes, and the magnitude of increased intrapulmonary oxygen pressure.

Oxygen was administered as an unconditioned stimulus to dogs at an increased pressure of between 15 mm Hg and 67 mm Hg in combination with a conditioned stimulus (a bell). The character of conditioned reflex activity was evaluated by changes in external respiration, heart activity, and bioelectric activity of the respiratory muscles.

Results obtained indicate the possibility of the formation of new, temporary connections when the sound of the bell is used in combination with increased intrapulmonary oxygen pressure. In this case, conditioned autonomic reflexes were formed first and motor reflexes were formed later.

141. Dark Adaptation and Conditioned Reflexes

"Some Peculiarities of Higher Nervous Activity of the Healthy Human Under Conditions of Adaptation to Darkness," by T. S. Stepanova, Academic Group of A. V. Lebedinskiy, Corresponding Member of Academy of Medical Sciences USSR and Leningrad Scientific Research Neurosurgical Institute imeni Plenov; Moscow, Zhurnal Vysshey Nervnoy Deyatel'nosti, Vol 9, No 6, Nov/Dec 59, pp 830-836

The author of this article states that 97 experiments were conducted on five healthy men and nine healthy women aged 24-46 to observe some of the peculiarities of conditioned motor and autonomic reactions during adaptation to darkness.

It was noted that the conditioned motor reaction preserves its level during adaptation to darkness. Its latency and magnitude vary in the dark within the same limits they do during exposure to light. The cutaneous galvanic reflex and vascular and respiratory reactions, recorded simultaneously within the motor component during the process of adaptation to darkness, become intensified, and their magnitude and duration increase; the opposite occurs during exposure to light.

A lower level of conditioned motor reaction in darkness was observed only in people who had a previous history of disease, fatigue, or a prolonged period of negative emotions. These conditions contribute to temporary functional weakening of the cortical cells.

142. Oxygen Saturation Studied

"The Effect of Respiratory Changes on the Degree of Arterial Blood Oxygen Saturation," by N. V. Sanovskaya, Laboratory of Physiology and Pathology of Respiration and Blood Circulation, Institute of Normal and Pathological Physiology; Moscow, Bulleten' Eksperimental'noy Biologii i Meditsiny, Vol 24, No 11, Nov 59, pp 8-12

The author of this article states that 58 experiments were performed on rabbits, cats, and dogs under urethan anesthesia to determine the effect of respiratory changes (pulmonary ventilation, tempo, rhythm, and amplitude of respiratory movements) on the degree of arterial blood saturation with oxygen.

Results of the experiments showed that arterial hypoxia occurs as a result of disturbance in the normal ralationships between pulmonary ventilation and blood supply in the lungs. Pulmonary aeration may be inadequate when the over-all level of pulmonary ventilation drops, and also when ventilation of different parts of the lungs becomes irregular as a result of uncoordinated respiratory movements.

143. Cardiovascular System in Cold Climates

"The Influence of the Arctic and Antarctic Climate on the Cardiovascular System," by N. R. Paleyev, Institute of Therapy, Academy of Medical Sciences USSR, and Department of Polar Medicine, Main Administration of Northern Sea Route; Moscow, Terapevticheskiy Arkhiv, Vol 31, No 11, Nov 59, pp 17-22

According to this article, the author studied the effects of the Central Arctic climate and of the more rigorous climatic conditions of the Antarctic region on the cardiovascular system of comparatively healthy human beings. Personnel on the drifting station North Pole 4 were kept under observation for one year; members of the Mirnyy station in the Antarctic were under observation for 1 1/2 years. On the basis of data collected, it was concluded that climactic conditions of both the North and South poles produce similar, pronounced hemodynamic adaptation reactions, and they exert a hypotensive action. The changes noted seem to be more pronounced in the Antarctic region.

The process of reacclimatization, after sojourns in the Arctic region, lasts 6-8 weeks or longer.

144. Differentiated Inhibition Studied

"Comparative Physiology of Differentiated Inhibition," by V. L. Bianki; Leningrad, Vestnik Leningradskogo Universiteta No 15, -- Seriya Biologii, No 3, 1959, pp 103-109

This article states that results of experiments conducted on 7 crucians (Carassius carassium L.), 5 tortoises (Testudo horstfieldi Gray), 7 rabbits (Oryctolagus cunicalus L.), and 6 dogs (Canis familiaris) showed that the rate of formation of differentiated inhibition is the same. No data were obtained on the resistance of crucians to differentiated inhibition. In the case of tortoises, an average of 93.6 applications of differential stimuli were necessary before differentiated inhibition was formed; in rabbits, 89 applications; and in dogs, 29.7 applications. Greater resistance was found in rabbits and dogs. In rabbits, an average of 97.6 applications of differential stimuli were needed before the initial manifestations of differentiated inhibition were noted; in dogs, an average of 29.7 applications were necessary. This shows that differentiated inhibition appears more rapidly in animals which are at a higher level of evolutionary development.

To obtain more accurate data for comparison of the rate and the dynamics of the formation of differentiated inhibition in animals of different phylogenetic levels, special consideration was given to uniformity of the experimental conditions.

Interest in internal inhibition, particularly general and differentiated inhibition, has been increasing recently. This is substantiated by the fact that many articles have been published and greater interest has been shown in discussions on various aspects of the evolution of internal inhibition in connection with the general subject of comparative physiology of the higher nervous activity.

145. Hungarian Research on Ultrasound Reported

"Effect of Ultrasound on the Diffusion of Thiocyanate Ions in Frog Muscles," by Gy. Tamas and Gyorgyi Ronto, Institute of Medical Physics, Medical University, Budapest; Budapest, Acta Biologica Academiae Scientiarum Hungaricae, Supplement No 3 (Proceedings of the Third Meeting of the Hungarian Biological Society, Budapest, 5-7 May 1959), 1959, pp 45-46

"The authors investigated the spontaneous diffusion and diffusion influenced by ultrasound in extracellular spaces of frog sartorii and gastrocnemii soaked in Ringer solution containing thiocyanate. During these experiments, the circulation and influence of the nervous system were inhibited to enable the measuring of the primary diffusion-acceleration effect of ultrasound.

"The product of diffusion and diffusion resistance was estimated by the authors for the thiocyanate ions in the extracellular spaces of muscles. Based on control experiments, the diffusion constant amounted to $3.6 \cdot 10^{-4}$ cm^2/min for both sartorii and gastrocnemii.

"Both outward and inward diffusion seems to be accelerated by ultrasound. The diffusion constant tested by the authors was $14.4 \cdot 10^{-4}$ cm^2/min. It is very likely that the pressure changes in the sound field and cavitation gave rise to an increase in the diffusion rate. (Temperature level was held constant by an appropriate cooling system.)

"Results of a longer irradiation period (i. e., 15 min) strongly suggest that ultrasound increases the permeability of the cell-membrane for the thiocyanate ions. However, no deterioration of the cell wall could be established."

146. Effect of Ultrasonic Sound on Extracellular Diffusion of Rhodanate Ions

"An Investigation of the Diffusion-Increasing Effect of Ultrasound," by Gyula Tamas, Gyorgyi Ronto, and Imre Tarjan, Medical Physics Institute; Budapest; Magyar Fizikai Folyoirat, Sep/Oct 59, pp 407-414

"The authors examined the diffusion of rhodanate (thiocyanate, SCN) ions in the extracellular space of the frog sartorius and gastrocnemius muscles, and they determined the value of the coefficient of diffusion.

In the control muscles, this was equal to $3.6 \cdot 10^{-4}$ cm^2 / minute. Under the effect of ultrasound, diffusion increased both into and out of the extracellular space. The coefficient of inward diffusion was four times that of the control; for outward flow it was 15 percent smaller. Under the effect of ultrasound, the rhodanate ions enter the muscle in quantities beyond that needed to fill the extracellular space. This probably occurs because the rhodanate ions enter the muscle cells."

This paper was read at the Ultrasonic Colloquium in Budapest, 7 April 1959, and was submitted for publication on 25 April 1959.

147. Short Description of Ya. P. Korablev Aerosol Generator

"Disinfestation With the Aid of Ya. P. Korablev Aerosol Apparatus No 1," by Ya. P. Korablev; Moscow, Meditsinksaya Parazitologiya i Parazitarnyye Bolezni, No 5, Sep/Oct 59, p 619

The Ya. P. Korablev Aerosol Apparatus No 1 is a box-shaped metal appliance for generating aerosols. It has a capacity of up to 4 kg. Chief components of this apparatus are a cooler and extinguisher. The cooler is used to cool the bottom of the apparatus. The extinguisher, a cone-shaped cowl, is used to quench the flame which develops on heating of the thermal insecticidal mixture that is charged into the aerosol apparatus.

The author proposed a number of recipes for thermal mixtures containing DDT or hexachlorocyclohexane by means of which insecticidal aerosols can be generated.

The aerosol apparatus is designated for controlling many arthropoda inside buildings.

148. Centrifuge Which Converts Into Aerosol Generator

"Air-Driven Ultracentrifuge and Aerosol Generator and Their Application in Science and Practice," by V. Chizhinskiy and Ya. Koloushek, Institute of Biophysics, Medical-Hygiene Faculty, Charles University, Prague; Moscow, Kolloidnyy Zhurnal, Vol 21, No 6, Nov/Dec 59, pp 739-746

Air-driven centrifuges and their applications are reviewed. A simple portable centrifuge, driven by compressed air, is described. This apparatus was designed by one of the authors, V. Chizinskiy.

After some modifications, this centrifruge may serve as a generator of highly dispersed aerosols. The upper side of the rotor was converted into a polished surface into the center of which a liquid may be introduced at a determined rate. The liquid is converted into an aerosol on contacting the revolving surface. The size of the aerosol particles can be regulated by changing the number of revolutions of the rotor. The aerosol produced by this generator has a very narrow range of drop diameters, the smallest of which measured about 0.2 micron.

The authors present a novel method of measuring the number of revolutions of the centrifuge. Several fields of application for the ultracentrifuge and aerosol are cited and discussed. These chiefly concern biological and medicoclinical studies and also disinfection, therapeutics, and prophylactics.

Radiology

149. Effect of Chronic External Gamma Irradiation on Peripheral Blood Composition of Dogs With Different Types of Higher Nervous Activity

"Changes of the Morphological Composition of the Peripheral Blood of Dogs With Various Types of Higher Nervous Activity Under the Effect of Chronic External Irradiation by Small Doses of Gamma Rays (Co^{60})," by A. F. Makarchenko, M. F. Sirotina, and R. S. Zlatin; Kiev, Fiziologichniy Zhurnal, Vol 5, No 6, Nov/Dec 59, pp 769-773

Systematic observations were conducted on seven dogs from which blood was withdrawn several times during a one-year period to establish hematological norms. Four of these dogs were subjected to chronic total irradiation by small doses of gamma rays from radioactive cobalt. The irradiation was carried out daily (six times per week) for 6 hours, with a total dose of 0.05 r per day. The remaining three dogs served as controls.

A systematic study of the morphological composition of the blood of the dogs subjected for a year to general external irradiation by small doses of gamma rays from radioactive cobalt shows that the perceptible changes in the hematological indexes are distinguished by their great lability. The most marked change was the polycythemic reaction which is observed in the majority of experimental animals during the 5th through the 9th month after the beginning of irradiation. During this same period, a marked increase in the number of thrombocytes is noted.

Data in this research present certain bases for considering that at definite periods during the effect of penetrating radiation, the response reactions observed in the morphological composition of the peripheral blood of animals possessing a strong type of higher nervous activity differ from the response reactions in animals possessing a weaker type of higher nervous activity.

During a year, no degenerative symptoms were observed in the morphological components of the peripheral blood of the experimental animals.

150. Gamma Irradiation Effect on Animal Skin

"The Skin Condition of White Mice After Total Gamma Irradiation by Radioactive Cobalt," by L. V. Funshteyn, Central Scientific Research Roentgeno-Radiological Institute, Ministry of Health USSR; Moscow, Vestnik Dermatologii i Venerologii, Vol 33, No 6, Nov/Dec 59, pp 42-46

The purpose of this research was to study the effects of gamma irradiation on the skin.

Sixty-six white mice were subjected to a single whole-body gamma irradiation from cobalt in total doses ranging from 2,500 to 19.5 r (at a rate of 19.5 r per minute). Histological studies of sections of various organs of experimental mice sacrificed 12 hours to 60 days after irradiation indicated that macroscopically the skin and hair remained unchanged for up to 2 months. The most common histological changes in the basal layer of the epidermis appeared in the form of inhibition of mitotic activity and vacuolization and deformation of the cells and of the nuclei.

The author presents the following explanations.

It is known that after the external total-body irradiation, the white mice develop changes in which injury to the skin has an unusually great significance and perhaps precedes major injury to the internal organs. In contrast to this, after the external gamma irradiation of mice, the skin remains unchanged macroscopically, whereas, histologically the changes are minimum and can in no way be compared with those due to beta particles. The less damaging effect of gamma irradiation on the skin is caused by the smaller density of ionization by which the physical characteristic -- the greater penetrating capacity -- of this type of radiation is determined.

151. Further Information on Six Cases of Acute Radiation Sickness in Victims of Nuclear Reactor Accident in Yugoslavia

"A Study of Six Cases of Acute Radiation Sickness Among the Victims of a Nuclear Reactor Accident in Yugoslavia," by H. Jammet, G. Mathe', et al., reviewed by D. E. Grodzenskiy and F. G. Krotkov; Moscow, Meditsinskaya Radiologiya, Vol 4, No 9, Sep 59, pp 83-90

The French journal Revue Francaise D'Etudes Cliniques et Biologiques, No 3, 1959, published three articles which presented for the first time a scientific description of the nature of injuries received by, and the results of treating acute radiation sickness in, the six victims of a nuclear reactor accident in Yugoslavia on 15 October 1958.

This issue of Meditsinskaya Radiologiya presents a review of the first of the three French articles. The reviewers discuss in detail the problem of the transfusion and transplantation of homologous bone marrow and the role of this method in treating radiation injuries. Graphs and tables present data on the amount of neutrons, gamma rays, and total radiation doses received by each victim. The general condition of the victims during the latent period and at later stages of radiation sickness, symptomatic therapy, peripheral blood studies, and the changes in liver and kidney functions, and in spermatogenesis are discussed. Attention is called to the difficulty of determining the dose of irradiation since individual dosimeters were rendered useless during this accident. Evidently, in cases of accidents, it is necessary to have dosimeters with a range for gamma radiation of 50-1,000 r.

With regard to the prognosis, the authors draw the following conclusions: The possibility of a second immunological reaction in those to whom bone marrow was administered should not be excluded. In a very short time, shifts in the blood picture, abnormal spermatogenesis, and asthenia become possible remote sequelae which increase the probability of leukemia and various forms of cancer.

"The Transfusion and Transplantation of Homologous Bone Marrow to People Irradiated by Large Doses due to a Nuclear Reactor Accident," by G. Mathe, H. Jammet, et al., and "The Method of Quantitative Determination of the Origin of Erythrocytes in Four People Irradiated by Large Doses, and Their Treatment by Bone Marrow Transfusions," by C. Salmon, reviewed by D. E. Grodzenskiy and F. G. Krotkov; Moscow, Meditsinskaya Radiologiya, Vol 4, No 10, Oct 59, pp 85-92

In Meditsinskaya Radiologiya, No 9, September 1959, the first of three French articles describing the acute radiation syndrome in the six Yugoslav scientists who were victims of a nuclear reactor accident was discussed. This report concerns the material published in the two remaining articles, the titles of which are given above.

The reviewers consider various pertinent data presented by the French authors. Six homograms belonging to the six victims are presented and discussed.

In commenting on the cause of the ineffectiveness of embryonic myeloid cell transplantations in the victim most severely affected, the reviewers point out that cytopenia could not have been expected to adjust until 10 days after the transplantation of the bone marrow; however, the course of the sickness was so severe that this period seemed too long.

The reviewers also state that the number of embryonal cells transplanted (4 billion) was insufficient. The advantage of using bone marrow transplantations from adult donors is mentioned.

Bone marrow "survival" was the direct index for the immunological method of determining the number of erythrocytes formed from the bone marrow that was transplanted. It was established that the concentration of such erythrocytes was increased during the first month and that the total number of erythrocytes produced by the bone marrow is significantly greater than the number of erythrocytes administered.

152. Therapeutic Use of Radioactive Plastics

"Radioactive Plastics" (Preliminary Report), by Prof Z. N. Blyumshteyn, chief of Chair of Biological and Physical Chemistry, Kazan Medical Institute; Kazan', Kazanskiy Meditsinskiy Zhurnal, No 5, Sep/Oct 59, pp 96-97

At present, plastics are very extensively used in various fields of industry, in medicine, and in households, etc. The scope of their use could be further expanded if radioactive substances were introduced into plastics and used as emitters. Such emitters could be prepared in various sizes, shapes, and activity.

Radioactive substances can be introduced into plastics by the same method used for introducing any inorganic salt, but with the observance of the necessary precautionary measures.

The author used the method of introducing salts which was developed by Ye. V. Kaznetsov and G. Kh. Kamay (Kazan Chemicotechnological Institute); certain variants were introduced to suit the conditions. Uranium salts were the first type of radioactive substances introduced into plastics. By virtue of the constancy of their emissions, uranium plastics were used as a standard for establishing the performance characteristics of installation B, computer tubes, electrometers, and other appliances. The uranium plastics obtained were transparent and uniform in color. These properties, according to the author's observations, did not change for several years (4-5 years).

The stability of the bonds of uranium salts with the plastics (methyl meta-acrylate) was verified by keeping the samples in water for a long time. No traces of uranium compounds were detected in the extract.

The next step in the author's work was the introduction of radioactive cobalt (Co^{60}) salts in the form of nitrate. The main reason for introducing cobalt salts was to prepare radioactive plastics for therapeutic purposes. The preparations thus obtained must have very high activity which amounts to as much as 10 millicuries. Cobalt plastics neither dissociate nor dissolve in water or in alcohol. No water is lost from these cobalt preparations, which differ from the radioactive preparations now used in practice, in the following respects: the latter are "point" preparations contained in metal needles; the Co preparations are placed over tumors in accordance with definite rules, and in accordance with their activities and with the site of tumor injury; the radiocobalt preparations which are prepared represent plate (applicators) of different shapes and thicknesses which must completely cover a tumor. It is thus possible to obtain, in the area which lies perpendicular to the plate, approximately uniform irradiation of the tumor with regard to the energy and depth of irradiation of the tumor at the specified area which is equal to the size of the plastic material. In the author's opinion the tumor will be better and more uniformly irradiated if preparations with smaller quantities of radioactive substances are used. Experimental and clinical verification is necessary.

For treating certain superficial neoplasms (for example hemangioma, sarcoma and cancer of the eyelids, etc.), it is necessary to prepare thin elastic films which meet a number of requirements. They must not be altered by sterilization or by treatment with water or alcohol. For these reasons, chloro-sulfonated polyethylene films which meet the above-mentioned requirements are used; besides, they may be used repeatedly. This is a very important factor since it makes it possible to introduce into plastics long-lived radioisotopes, for example, strontium (Sr^{90}). The minor dose change makes it very valuable for medicinal purposes.

Judging from calculations, it is very easy to prepare films with a high activity and a 0.2-0.3-mm thickness.

The author has succeeded in introducing into such a type of film nonradioactive salts of strontium, cobalt, and other elements and, by using X-ray diffraction pictures, has checked the uniformity of their distribution. Visually, such uniformity has been attained.

Good chloro-sulfonated polyethylene films have also been obtained by introducing the radioisotope of phosphorus (P^{32}) in the form of a dry salt of $Na_2 HPO_4$ which is extensively used for medicinal purposes, and in the form of liquid applicators.

A study of these films shows that water leaches out a very insignificant amount of radiophosphorus from the film, but in this case it is unimportant because of the short period of application, and the fact that the film is used only once (short period of decay of P^{32}).

The use of such films is a definite improvement because of the ease of its application and the simplicity of protecting the surrounding environment from irradiation. The dosage, also, is significantly more accurate in this form than in solution (in the gauze compress).

Of course, such films can be used for other purposes and as the need arises will be prepared from various isotopes, including the long-lived isotopes, along which line the author's research continues.

153. Isotopes Shop Opened in Moscow

"Our Peaceful Atom," by E. Kudryavtsev; Moscow, Izvestiya, 18 Dec 59, p 4

An exhibit hall where isotopes will be displayed has been opened in Moscow on Lenin Prospekt. This article states, however, that cautious neighbors need not be alarmed. First of all, not all isotopes emit dangerous radioactive radiations. Secondly, the radioactive isotopes and sources of nuclear energy which are very dangerous will be stored in the suburbs of the capital in special containers, and from here the items will be delivered to the purchasers.

The purchasers will not be able to see the radioactive isotopes, but will be able to obtain information about them from catalogues and various other facilities. Samples of the newest apparatus will be displayed at this exhibit. Films on the use of isotopes in the Soviet national economy will be shown at the movie hall. Salesmen who are experienced engineers and technicians will be on hand for consultation and help in the selection of the items.

Various protective equipment and clothing will be sold at this shop. Containers and safes for the storage of radioactive materials, all-purpose protective chambers, exhaust hoods, air-tight suits, cast iron and lead slabs for covering the walls of radiation laboratories, and special respirators -- all of which are designed for protection during work with radioactive isotopes and sources of nuclear radiation -- will be sold.

People of various professions are expected to visit the shop because atomic energy has become a tool in the hands of man and has become a necessity in the most ordinary tasks.

Examples cited are the detection of damage in underground pipelines, the diagnosis and treatment of certain diseases, and the tracing of causative agents of diseases in oak trees.

Frequent visitors to the shop will include geologists who use isotopes for discovering new deposits, metallurgists who use radioactive isotopes for discovering the necessary conditions in smelting for obtaining high-quality metals, and agricultural workers who have learned that agricultural products can be preserved through small amounts of radioactive irradiation.

154. Hungarian Civil Defense Research on Use of AET for Preventing Radiation Sickness

"Examinations With Preparations Having a Radiation Protection Effect -- Effect of S-aminoethylisothiouronium Br. HBr. (AET) /S-aminoethyliso (pseudo) thiocarbamide hydrobromide/ on Survival of Irradiated Animals," by Med Maj Dr Lazlo Sztanyik and Erika Mandi; Budapest, Honvedorvos, Oct/Dec, 59, pp 278-285

This is the first of two articles prepared with the support of the National Civil Defense Command of the Ministry of the Interior (Belugyminiszterium Orszagos Legoltalmi Parancsnoksaga) and is based on work done by the Health Service of the Hungarian People's Army (Magyar Nephadsereg Egeszsegugyi Szolgalata) and the Frederic Joliot-Curie Central Radiobiology Research Institute ("Frederic Joliot-Curie" Kozponti Sugarbiologiai Kutato Intezet) directed by Dr Vilmos Varteresz.

The article cites 19 Western sources and one Soviet source -- L. F. Semenov's report to a radiobiology conference in Moscow, 1957, in which Semenov verified previous Western discoveries. The article discusses Western work with cysteamine (mercaptoethylamine, MEA) but notes that this is too sensitive to oxidation and, even in a nitrogen atmosphere, can be stored only for limited periods. "For example, within one year the quantity of free SH groups in the domestic cysteamine preparation decreased by roughly 30 percent." The article also notes that the optimal MEA concentration for protection against radiation is very near the toxic level.

Turning from MEA to AET, the article notes that the latter is a more stable compound. In their experiments, the Hungarians used 670 white mice, 80 tan mice, and 10 Wistar rats. The animals were subjected to X-ray irradiation; the experimental animals received injections of AET in 0.2 ml of physiological saline solution 5-10 minutes before irradiation; the control animals received injections of plain physiological saline solution. In some experiments, AET was given after irradiation. Survival after 30 days was the measure of effectiveness. The effects of domestic and foreign AET were compared.

No statistically significant difference in the toxicity of foreign and domestic AET was noted. Among the control animals a 50-percent mortality rate followed a dosage of 450 r; 25 percent survival 500 r, and no survivals at 30 days resulted from doses of 600 r and more. Survival was greatly increased by the preirradiation injection of AET -- 25-30 percent of the female mice treated with 300 mg/kg AET prior to irradiation survived doses of 900 r. The 300 mg/kg injection corresponds to 6 mg per mouse. Heavier injections produced convulsions. Tables and curves plot the survival rate over time for various radiation and AET dosages. AET given after irradiation did not decrease and may even have increased the death rate as compared with the controls. No statistically significant difference between domestic and foreign AET was noted.

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The article concludes: "On the basis of our experimental results we can confirm data according to which AET can be considered one of the best of the presently known chemical radiation protection substances. In our next report we will discuss pharmacological examinations. We want to thank Dr Karoly Nador, Chief of the Pharmacological Research Department of the Experimental Medical Sciences Research Institute of the Hungarian Academy of Sciences, who prepared the AET and placed it at our disposal."

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"Investigations of Preparations Having a Radiation Protection Effect -- Pharmacological Effects of AET," by Med Maj Dr Laszlo Sztanyik and Dr Lajos Gyorgy; Budapest, Honvedorvos, Oct/Dec 59, pp 285-293

This is the second of two articles prepared with the support of the National Civil Defense Command and, like the first, makes numerous references to Western sources. In their experiments, the Hungarians used 15 cats under the effects of anesthetics of various types. Blood pressure, respiration, and muscle contraction (eyelid artificially stimulated by electric shock) were recorded on a kymograph. Various kymograms are reproduced, the effect of AET is compared with that of other drugs, and the effects of AET before and after decapitation of the subject are compared.

The article concludes: "We did not observe any pharmacological properties which would satisfactorily explain the radiation protection effect. Therefore, we have to accept, for the time being, the opinion of Doherty [Shapira, Doherty, and Burnett; Rad. Res., 7:22, 1957]... We have done further examinations in connection with the mechanism and we will report on these later."

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155. Hungarians Find Dextrose Solution Useful in Treating Radiation Sickness

"Experimental Therapy of Animals Irradiated With Sublethal X-Ray Doses -- the Role of Various Sugars in Treating Radiation Sickness," by Dr Dezso Tanka, Andras Vincze, and Gyula Binder; Budapest, Honvedorvos, Oct/Dec 59, pp 293-297

This article is based on work done at the Pathological Histology Laboratory of the National Rheumatism and Spa Affairs Institute (Orszagos Rheuma es Furdougyi Intezet), directed by Karoly Farkas, and at the United Medicine and Food Supplements Factory (Egyesult Gyogy- es Tapszergyar).

The authors review Western literature on the role of sugars in liver detoxication processes and suggest that sugar solutions have several beneficial effects in radiation protection: replacement of fluids; aiding detoxication; hindering proteolysis; and protecting proteins against denaturing effects. They then review Western experiments in this field.

In their own experiment, the Hungarians used 300 mice of two breeds. The mice were irradiated by a Siemens "Stabilvolt" deep therapy X-ray machine, from which they received 300 r. The solutions examined were 10 percent dextrose and 10 percent fructose, with 0.4 ml per mouse given intraperitoneally half an hour to 3 days after irradiation. Survival over a 30-day period was noted. The results obtained differed greatly depending on the breed of mouse. In one breed, dextrose had a protective effect, but in the other the dextrose-treated animals fared worse than the controls. In both cases fructose had no effect. The breed in which dextrose had a detrimental effect was more resistant to radiation than the other. It is suggested that sugar is beneficial only after a certain degree of damage is sustained.

156. Rumanian Nuclear Medicine Unit Begins New Treatments

"The Section of Nuclear Medicine in Cluj" (unsigned article); Bucharest, Scinteia Tineretului, 5 Jan 60, p 3

According to this item, the Section of Nuclear Medicine established recently at Clinical Hospital No 2 for adults in Cluj, has begun to use radioactive phosphorus treatments. In collaboration with the Dermatology Clinic of the hospital, X-ray and radioactive phosphorus treatments are being given in various cases of malignant reticuloses and granuloses and in capillary angioma.

In collaboration with the Institute of Radiology, treatments are being given in cases of post operative breast cancer with cutaneous metastasis. In collaboration with the Institute of Hygiene, the Physiopathology and Physiology Departments of the Medical and Pharmaceutical Institute in Cluj have begun experiments dealing with the degree of penetration of radioactive phosphorous into various malignant tumors and other experiments of practical interest.

Surgery

157. Antihemorrhagic Tampons

""Biological Antiseptic Tampon (BAT)," by K. D. Sedova; Moscow, Annotatsii o Lekarstvennykh Sredstvakh (Notes on Medicinal Preparations), No 9, 1959, pp 12-14

The tampons are prepared from the plasma and serum of human blood to which gelatine and blood coagulating and antibacterial drugs (such as penicillin, furacilin, and others) are added, according to a method developed by the scientists of the Leningrad Scientific Research Institute of Hematology and Blood Transfusion. Experimental investigations which were conducted at the Maxillo-Facial Clinic of Surgery and Stomatology of the Military Medical Academy imeni S. M. Kirov and other institutes established the hemostatic and antimicrobical properties of the tampon. The tampon is a dry, porous, yellowish mass which can be cut into pieces of different sizes and forms. It is easily reduced to a powder. It is recommended for use in wounds to prevent the loss of blood and the development of infections and as a hemostatic in cases of hemmorrhages. It can also be taken internally to arrest abdominal bleeding. Pieces of tampon intended for use in wounds (4x3x2 centimeters) are wrapped in parchment and packed into metallic boxes. Each piece of the preparation contains 100,000-500,000 units of penicillin.

158. Artificial Blood Circulation Equipment Improved

"Improvement of the Apparatus for Artificial Blood Circulation Designed at NIIEKhAiI," by M. G. Anan'yev, Ye. A. Vaynrib, A. A. Vishnevskiy, Yu. G. Kozlov, L. A. Levitskaya, L. N. Martynov, S. A. Mushegyan, and Ye. A. Frid, Scientific Research Institute of Experimental Surgical Apparatus and Instruments and Institute of Surgery imeni A. V. Vishnevskiy, Academy of Medical Sciences USSR; Moscow Eksperimental'naya Khirurgiya, No 5, Sep/Oct 59, pp 3-8

An improved model of the Soviet apparatus for artificial circulation the AIK (Apparat Iskustvennogo Krovoobrashcheniya) designed by NIIEKhAiI (Scientific Research Institute of Experimental Surgical Apparatus and

Instruments) has been tested experimentally at the institute and its performance proved to be satisfactory. The authors of this article participated in testing this apparatus. The apparatus was also tested and suggestions were made for improving it by the following: A. A. Vishnevskiy, of the Institute of Surgery imeni A. V. Vishnevskiy, Academy of Medical Sciences USSR; B. V. Petrovskiy, of the Hospital Surgical Clinic of the First Moscow Medical Institute; S. A. Kolesnikov, of the Institute of Thoracic Surgery, Academy of Medical Sciences USSR; Ye. N. Meshalkin, of the Chair of Thoracic Surgery of the Central Institute for the Advanced Training of Physicians; P. A. Kupriyanov, of the Chair for the Advanced Training of Physicians of the Military Medical Academy imeni S. M. Kirov; F. G. Uglov, of the Hospital Surgical Clinic of the First Leningrad Medical Institute imeni I. P. Pavlov; and A. G. Savinykh, of the Hospital Surgical Clinic of the Tomsk Medical Institute.

Since it has been clearly demonstrated that this apparatus ensures artificial circulation in conformity with all physiological requirements, the authors of this article suggest that it may be safely used in clinical practice in the USSR.

Miscellaneous

159. Organization of Medical Research in China Since Liberation

"Summary of China's Achievements in the Medical Sciences in the Past Decade," by Ch'ien Hsin-chung; Peiping, Jen-min Pao-chien (People's Health), Vol 1, No 12, Dec 59, pp 1092-1099

This article gives the following information on the organization of medical research in China since the advent of the Communist regime.

Under the Nationalist regime, China had only three research organs specializing in the medical sciences and only a few scientists. But since the liberation, the Communist Party and government has placed great emphasis on medical research. In 1950, the Ministry of Public Health established the All-China Commission for Research on Health Science (全国衛生科学研究委員會). This group was reorganized in 1955 under the name, Commission for Research in the Medical Sciences (医学科学研究委員會) [also known as Committee on Medical Research of the Ministry of Health]. Under the guidance of the party and government, this commission enlists the cooperative efforts of specialists and professors throughout the country in drawing up medical research plans, organizing academic activities, and stimulating scientific research. The Ministry of Health has also established committees and centers for research

in various specialties such as schistosomiasis, biologicals, dermatology and venereology, and dental caries and periodontology. Many committees for research in the medical sciences have been established on the provincial and municipal levels.

During the past few years, new research organs have been established and old ones expanded. Two large medical research agencies with modern equipment have been set up in Peiping: the Research Institutes of Chinese Traditional Medicine (Chung-i Yen-chiu-yuan) and the Chinese Academy of Medical Sciences (Chung-kuo k' I-hsueh K'o-hsueh-yuan). Each is the parent organization of a number of research institutes, such as the Institute of Parasitology; Institute of Epidemiology and Microbiology; Institute of Labor Hygiene Labor Protection, and Occupational Diseases; Institute of Dermatology and Venereology; Institute of Antibiotics; Institute of Pharmacology; Institute of Blood Transfusion and Hemopathology; Institute of Experimental Medicine; and others. There are in addition six institutes concerned with research on biologicals and one concerned with the analysis of biologicals. Some provinces and municipalities have set up branches of the Chinese Academy of Medical Sciences. Currently there are 108 research organs in China which specialize in the medical sciences, and if the research units of medical schools and hospitals are taken into account, the total would come to over 600. State appropriations for medical research in 1959 were 80 times more than appropriations for medical research in 1952. Medical scientists and technicians in China total more than 3,000. Medical publications in China have increased tremendously. Since the liberation, the Chinese Medical Association's serial publications have increased 60-fold. People's Medical Publishers have published over 39 million volumes in medical literature.

To consolidate the Chinese Academy of Medical Sciences, the Chinese Union Medical College was recently annexed to it. The reorganization resolved many problems related to shortages in personnel and equipment. It also ensures the smooth performance of key research activities.

"New China's Glorious Achievements in the Medical Sciences," by Ch'ien Hsin-chung, Vice-Minister of Health; Peiping, Chien-k'ang Pao, 1 Oct 59, p 3

This article lists the following institutes as components of the Chinese Academy of Medical Sciences:

Institute of Parasitology (寄生虫病研究所

Institute of Epidemiology and Microbiology) (流行病学微生物學研究所)

Institute of Labor Hygiene, Labor Protection, and Occupational Diseases (勞動衛生勞動保護與職業病研究所)

Institute of Tuberculosis (結核病研究所)

Institute of Dermatology and Venereology (皮膚性病研究所)

Institute of Hypertension (高血壓研究所)

Institute of Oncology (腫瘤研究所)

Institute of Blood Transfusion and Hemopathology (輸血与血液學研究所)

Institute of Antibiotics (抗菌素研究所

Institute of Biologicals (生物制品研究所)

Institute of Medical Radiology (放射医学研究所)

"Continue to Publicize the Achievements of China's Traditional Medicine," from the Research Institutes of Chinese Traditional Medicine; Peiping, Chung-chi I-k'an (Intermediate Medical Journal), No 12, Dec 59, pp 1-4

This article names four research institutes and a general hospital as subordinate bodies of the Research Institutes of Chinese Traditional Medicine in Peiping. The institutes are: Institute of Internal Medicine (內科研究所), Institute of Surgery (外科研究所), Institute of Acupuncture and Moxibustion (針灸研究所), and Institute of Traditional Drugs (中药研究所).

160. Soviet Psychiatric Rehabilitation

"On Psychiatric Rehabilitation in the USSR," by G. Martin, St Joseph's Hospital; Berlin, Das Deutsche Gesundheitswesen, Vol 14, No 51, 17 Dec 59, pp 2327-2331

The author, a member of the Association of Hygienists of the German Democratic Republic, reports on visits to the Institute of Defectology and Institute of Psychiatry of the Academy of Medical Sciences USSR, to the Korsakov Psychiatric Clinic of the First Moscow Medical Institute, and to the so-called Day Clinic of the Third Moscow Psychoneurological Clinic.

In Soviet medicine, psychiatry is given just as much attention as the other disciplines. Psychiatry and neurology are separated both in practice and in the chairs of the universities and independent medical academies.

The assignment of medical personnel to clinical installations in the Soviet Union follows a strict pattern, which is in keeping with all modern requirements: there is one physician for every 27.4 psychiatric patients and one nurse for every 5.8 patients. Each station also has additional male nurses. This means that, in practice, a station with 110 beds has four physicians and 20 nurses. The nurses work a 6-hour day. This arrangement guarantees proper care. The idea of rehabilitation is treated in the USSR not only as an aspect of curative medicine, but is closely associated with preventive medicine as well. Laws and regulations guarantee medical, social, and professional care of psychiatric patients from the beginning of incapacitation to final cure, or health and welfare conditions on a level with modern standards in the event of permanent invalidism.

In the USSR, rehabilitation is not a special discipline of medicine, but rather a function of the health service. The improvement of techniques through research is one task of the Institute of Psychiatry of the Academy of Medical Sciences.

The rehabilitation of adults is under the Ministry of Health and is separate from the rehabilitation of children or juveniles, which is under the Ministry of Education. The central establishment for this purpose is the Institute of Defectology, while research work for both adults and juveniles is closely allied with the Academy of Medical Sciences.

The dispensary is the organizational and practical center not only of the rehabilitation aspect of treatment, but of the psychiatric health service in general. There is at least one psychiatric dispensary in every Soviet city, and more, naturally, in the larger cities. There are 13 dispensaries (20 districts) in Moscow. The dispensary is almost always connected with a polyclinic, often with a so-called day clinic, and is allied with the pschiatric clinic, the dependents' ward, the labor office, schools, and factories. The dispensary is a type of interrogation center, which checks the patient's medical, professional, and social circumstances, coordinates the findings and recommendations of the allied and assigned institutions, and directs the patient to the proper place for his further treatment, or dismisses him from treatment. The primary consideration in this system is prevention; the number of persons actually to be rehabilitated remains small, since the rehabilitation process is rapid, continuous, and reliable.

In the simplest case, a patient needing psychiatric treatment would be sent from the dispensary to the psychiatric clinic and returned, after treatment, to the dispensary, from which he would be sent back to his regular work. In most cases, however, before being sent back to the dispensary, the psychiatric patient would be sent for a few weeks to the so-called reconvalescent department of the hospital for occupational therapy, then returned to his regular work. The psychiatric patients who do not respond satisfactorily to the treatment of the reconvalescence department are sent to the day clinic. In Moscow there is one day clinic for each dispensary, and three day clinics are attached to psychiatric clinics. At the day clinic of the Third Moscow Psychoneurological Clinic there are 800 beds (about 100 overflow at the time of the visit) and, 50 physicians or academy trained associates. The tables of organization include over 100 personnel, headed by a physician who is paid a salary equal to 1½ slots according to the plan. Other personnel observed include a head nurse, a "procedure nurse" (physical education instructor for patients), a medical-control nurse (dispenses medicaments), a social worker, a labor leader, five "instructors" (foremen), and one snack bar attendant.

As a rule, the patients are sent from the dispensary to the day clinic. The average stay is from 2 to 3 months. In general, the following disorders are represented among the day clinic patients: schizophrenia, epilepsy, oligophrenia, manic-depressive psychosis, somatogenesis (endocrinopathy), organic neurological with psychic complications, cerebrovascular disorders, etc. The patients live at home and spend the day (0900-1700 hours weekdays and 0900-1500 hours Sundays) in the day clinic. No work is done on Sundays. The day is spent as follows:

0900 hours -- breakfast (about 30-40 minutes)

0930 or 0940-1200 hours -- work

1200-1230 hours -- recess

1230-1330 hours -- work

1330-1500 hours -- lunch, followed by free period

1500-1700 hours -- work

After 1700 hours, the patients may go home or attend cultural affairs in the day clinic (literary discussion, theater, etc.) There are several craft shops in the day clinics; the products are sold within the regular state production plan; all equipment in the day clinics is kept in order by the patients. The day clinic is thus for patients who required a period of slow readjustment before returning to their regular work.

There are also special day clinics for chronically ill patients not expected to return to their regular work and lives. The occupational therapy is simpler, and the wages or commissions paid are less than in the regular day clinics.

There is a fifth rehabilitation establishment for adult psychiatric patients, the so-called invalid cooperatives, to which the dispensary sends patients whose defects are considered irreversable or who are incapable of performing the occupational therapy assignments of the regular or special day clinics. There are craft facilities for those able to use them; the products are not incorporated in the work norms of comparable products manufactured on the outside, but the patients receive comparable pay.

The Soviet Union has had the best results in the rehabilitation of psychiatric patients into agricultural work.

At the Moscow Institute of Neurology, Academy of Medical Sciences USSR, special scientific research and practical rehabilitation has been done in the treatment of aphasia and other speech disorders.

The Institute of Defectology of the Ministry of Education is responsible for the treatment of juvenile psychiatric patients. The institute has an annual budget of 3 million rubles; it employs 50 scientific associates; its task is the research and development of methods of instruction and rehabilitation for children and juveniles who are blind, partially blind, deaf, partially deaf, mentally retarded, and spastic. The recommendations made by the institute are binding for schools and clinical stations of the entire Soviet Union. The Institute of Defectology has 11 departments for the following:

1. Scientific research and teaching methods for deaf children.

2. Scientific research and teaching methods for partially deaf children.

3. Research on the psychology of deaf and partially deaf children.

4. Research on the physiology and pathophysiology of speech disturbances.

5. Laboratory of phonetics and acoustics.

6. Examination and research department for blind and mentally retarded children.

7. Psychiatric examination of mentally retarded children and determination of their limits of learning.

8. Research on the psychology of mentally retarded children.

9. Comprehensive physiopathology of all studied defects in accordance with Pavlovian theory.

10. Department for sensory studies on all defective children.

11. Research department for children who are both blind and deaf.

Three experimental schools are attached to the institute, and a close relationship exists between the institute and several Moscow schools for deaf and blind children.

At the Institute of Defectology, a study has been made of the effect of Galantamine (a Prostigmine derivative) on the motility of spastic musculature. A book on the subject by M. B. Eidinowa /Aydinova/ (English edition to appear soon) reports successful improvement of the rehabilitation of spastics through a combination of Galantamine injections and the usual treatment through exercise.

Another problem with which the institute is concerned at present is whether children who have been physically impaired by poliomyelitis are psychically altered primarily or secondarily.

VIII. METALLURGY

161. Production of Oxygen in USSR for Applications in Ferrous Metallurgy

Kislorod v Chernoy Metallurgii (Oxygen in Ferrous Metallurgy), by A. Leskov, reviewed by Prof M. Korolev, Doctor of Technical Sciences, and G. Gurskiy, Deputy Director of Novo-Tul'sk Metallurgical Plant, Laureate of a Lenin Prize; Moscow, Promyshlenno-Economicheskaya Gazeta, No 7 (615), 17 Jan 60, p 4

During the last year of the current Seven-Year Plan, about 25 million tons of cast iron and more than 60 million tons of steel will be smelted with the use of technical oxygen. Blast furnace ferroalloys, Bessemer converter steel, and steel smelted in electric furnaces will be produced at the end of the Seven-Year Plan exclusively by applying oxygen. The economic aspects of the application of oxygen in ferrous metallurgy have not yet been considered to an adequate extent. Leskov's book, published by Gosplanizdat, gives for the first time detailed treatment to the economic aspects of the application of oxygen in ferrous metallurgy. Particular attention in Leskov's book is paid to work on the blowing of blast furnaces with natural gas modified with oxygen and to the burning of natural gas that has not been preheated in open-hearth furnaces in a stream of pure oxygen.

In discussing the most advantageous methods of applying oxygen, the author of the book considered increases in the efficiency of metallurgical plants achieved thereby, the economy of fuel resulting from the application of oxygen, the resulting lowering of raw material costs and labor costs in the production of cast iron and steel, and the reduction of capital investments. The calculations made by Leskov are also concerned with related branches of industry. Wide consideration of all these aspects makes it possible to arrive at correct answers to the question as to which of the many methods of using oxygen in smelting and steel-making is the most advantageous from the economic standpoint. The best procedure in blast-furnace operation is blowing into the furnaces natural gas modified with oxygen. Fully processed ore is used. In open-hearth operation, the best approach is burning in a stream of pure oxygen natural gas which has not been preheated while specially treated metal scrap and liquid cast iron with a low content of manganese are used. In the operation of Bessemer converters, ordinary open-hearth cast iron is treated by blowing with pure technical oxygen from the top. The volume of the converters must be increased so that their capacity is at least 100 tons and the shape of the converters has to be modified. In making steel in electrical furnaces, the metal is treated by blowing with technically pure oxygen, and the volume of the furnaces is increased until their capacity is 185 tons or more.

In discussing ways in which the cost of oxygen can be lowered, the author concludes that it is necessary to expand by every possible means the construction of high-capacity oxygen-producing plants with installations producing up to 35,000 cubic meters of oxygen per hour or more. This will make it possible to lower the cost of oxygen to 6 kopecks per cubic meter. Recovery and use of by-products of oxygen-producing plants (krypton, argon, xenon, and nitrogen) will lower the cost of oxygen to one kopeck per cubic meter, according to the author's calculations. Furthermore, a very large quantity of nitrogen fertilizers will be produced if this is done. The book suggests interesting schemes of combining the operation of metallurgical plants with that of chemical plants. By coordinating the two types of production, one can produce the valuable fertilizer urea. By using the urea together with phosphate fertilizers derived from the slag of steel-making operations when cast-iron rich in phosphorus is used, agricultural yields can be increased greatly.

The book has some shortcomings, primarily, the absence of economic calculations to arrive at changes in the cost of ferrous metals which will be produced at the large-capacity metallurgical plants that are being created in the East. In analyzing the technical and economic aspects of the question of the advisability of blowing blast-furnaces with natural gas, the author of the book does not indicate that experience in this field acquired in the USSR and abroad relates solely to the smelting of open-hearth cast iron.

The proposals concerning experiments on the blowing with natural gas of the blast furnaces at the Novo-Tul'sk and Kosogorsk plants in connection with the production of ferroalloys lack technological justification and are premature for this reason. One must first solve the problems arising in connection with the smelting of foundry cast iron.

The author of the book is of the opinion that the capacity of Bessemer converters employing oxygen can be increased only to 100 tons. In the reviewer's opinion, one must consider Bessemer converters with a capacity of up to 300 tons.

On the whole, Leskov's book represents an important contribution to the literature dealing with the intensification of metallurgical processes by applying oxygen.

162. Constitutional Diagram of Titanium-Vanadium-Niobium System

"Constitutional Diagram of the Titanium-Vanadium-Niobium System," by I. I. Kornilov and V. S. Vlasov; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 7, Jul 59, pp 1630-1637

A constitutional diagram of the system Ti-V-Nb was constructed on the basis of determinations of the microstructure.

163. Aluminum-Niobium Alloys

"Investigation of the Interaction Between Aluminum and Niobium," by V. M. Glazov, V. N. Vigdorovich, and G. A. Korol'kov, Institute of Metallurgy imeni A. A. Baykov, Academy of Sciences USSR, and Moscow Institute of Nonferrous Metals and Gold imeni M. I. Kalinin; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 7, Jul 59, pp 1620-1624

The constitutional diagram of aluminum-niobium alloys containing small quantities of niobium was constructed. The macrostructure and microstructure of these alloys and also the microhardness of solid solutions in relation to the composition of the alloy were determined.

164. Effect of Certain Elements on Scale Resistance of Nickel

"Effect of Certain Elements on the Scale Resistance of Nickel," by Prof A. S. Tumarev and Docent L. A. Panyushin, Leningrad Polytechnic Institute; Stalinsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Chernaya Metallurgiya, No 8, Aug 59, pp 117-121

Investigations were conducted to obtain comparative data on the scale resistance of pure nickel (composition not given) and binary alloys of nickel (electrolytic, 99.85% pure) with aluminum, chromium, manganese, titanium, and tungsten. Problems on the theory of gas corrosion and methods for investigating it were not examined. Specimens were exposed to dry oxygen through the temperature range from 800 to 1,200°C and were weighed at one-hour intervals over an 8-hour period without removing them from the furnace. Data presented may be summarized as follows:

1. Ni-Al alloys-- steady decrease of scale resistance with increase of aluminum content up to 4%, continuous increase with increase of aluminum content from 4 to 8-9%, and no significant change with aluminum content above 8-9%.

2. Ni-Cr alloys-- steady decrease of scale resistance with increase of chromium content up to 4-5%, continuous increase with increase of chromium content from 4-5% to 14-15%, and no significant change with chromium content above 14-15%

3. Ni-Mn alloys-- irregular, marked decrease of scale resistance with increase of manganese content.

4. Ni-Ti alloys-- decreased scale resistance which becomes amplified steadily with increases in temperature and titanium content.

5. Ni-W alloys-- continuous decrease of scale resistance with increase of tungsten content up to 7% and a steady increase with increase of tungsten content from 7 to 10%.

165. Scale Resistance of Alloys of Nickel-Aluminum-Chromium System

"Scale Resistance of Alloys of the Ternary System Nickel-Aluminum-Chromium," by Prof A. S. Tumarev and L. A. Panyushin, Leningrad Polytechnic Institute; Stalinsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Chernaya Metallurgiya, No 9, Sep 59, pp 125-131

Comparative data are presented on the effect of varying amounts of aluminum and chromium, both singularly and jointly, on the scale resistance of alloys of the ternary system Ni-Al-Cr. Aluminum in quantities up to 2% sharply increases scale resistance of alloys containing 12% chromium but shows little effect in quantities over 2%. Addition of chromium to alloys containing 9% or higher quantities of aluminum shows little effect on scale resistance. Data on scale resistance of alloys of the binary systems Ni-Al and Ni-Cr are the same as those presented in the article, "Effect of Certain Elements on the Scale Resistance of Nickel," which was written by the same authors and appears in the No 8 issue of the above-indicated journal.

166. Hydrogen Reduction of Co_3O_4

"Concerning Certain Peculiarities in the Kinetics and Mechanism of the Process of Reducing Cobaltous-Cobaltosic Oxides With Hydrogen," by A. N. Kuznetsov and N. F. Kulish, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 4, Jul/Aug 59, pp 53-58

Investigations conducted on the process of reducing Co_3O_4 in the temperature range from 225 to 480°C with hydrogen at atmospheric pressure showed that this process develops autocatalytically with the presence of a period of induction. It was established that Co_3O_4 is reduced in one stage directly to metallic cobalt at temperatures below 291°C; below the temperature point K = 291°C cobaltous oxide becomes thermodynamically unstable and is not accumulated in the specimen during reduction. At temperatures above 291°C cobaltosic oxide becomes thermodynamically stable and reduction occurs in two stages through the formation of CoO. Many similarities are noted in the reduction mechanism of corresponding oxides of cobalt and iron.

167. Heat Resistance of Alloy Kh25Yu5 (No 2) at 600 - 1,200°C

"Heat Resistance of the Iron-Chromium-Aluminum Alloy No 2 at Temperature From 600 to 1,200°C," by V. S. Mikheyev; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 4, Jul/Aug 59, pp 66-72

Alloy No 2 (Kh25Yu5 according to GOST, containing 23-27% Cr, 4.5-6.5% Al, 0.5% Ti, and the rest Fe and impurities) in the cold worked-annealed state (recrystallized fine grain, 0.001 - 0.002 mm^2 size) at temperatures of 700°C and below deforms at the highest rate in comparison with an alloy annealed at 850-1,000°C with a grain size of 0.009 - 0.05 mm^2 and larger. Stress resistance of the alloy increases sharply with increase of annealing temperature and grain size. Heat resistance of the alloy based on a 3-5-mm bending deflection after 500 hours is characterized by the following stress-temperature limits (stress in kg/mm^2, temperature in degrees Centigrade): 4-600, 1-700, 0.3-900, and 0.025-1,200 (after 300 hr).

168. Book on Welding Titanium and Its Alloys

Svarka Titana i Yego Splavov (Welding Titanium and Its Alloys), by M. Kh. Shorshorov and B. V. Nazarov, Mashgiz; Moscow, 1959, 136 pp

Basic properties and methods for producing titanium and titanium alloys are explained briefly. Studies are presented of the effects of chemical composition of alloys and impurities on weldability, the control of structure and properties of welded joints, and the fundamentals concerning selection of conditions for welding and heat treatment. Arc welding in inert gases and under fluxes, electroslag welding, resistance welding, and brazing are described. Information is contained on production experience of Soviet plants. Information is also included from foreign literature on welding and application of welded titanium and titanium alloys. Data on the Soviet alloys VT1, VT3, VT5, VT6, OT4, VT1D, VT1-1, VT1-2, IMP-1, and IMP-1A are compared with foreign alloys. The book is designated for scientific workers and plant engineers (technologists and designers) working in the field of welding and also in the development of titanium alloys and their application in weldments.

169. High-Speed Induction Heating of High-Alloy Steels and Alloys

"High-Speed Induction Heating of Blanks Made of High-Alloy Steels and Alloys," by Yu. M. Bogatyrev; Moscow, Kuznechno-Shtampovochnoye Proizvodstvo, No 12, Dec 59, pp 36-42

Investigations were conducted to study the distribution of temperatures along cross sections of blanks made of steels Kh17N2 and LKh18N9T and alloy EI607 under different conditions of induction heating, and also the structure and mechanical properties of the metal of blanks heated by induction and in a furnace and subsequently deformed in the hot state. Test results show that induction heating of these metals for subsequent hot pressure working is completely feasible and that the temperature limit may be increased from 100 to 120°C permitting a decrease in the number of intermittent heatings without impairing the structure of the metal to any significant extent. In certain cases, scale formation by induction heating is as little as one twenty-third the amount in furnace heating. The work mentioned above was conducted at the Central Scientific Research Institute of Technology and Machine Building. Metals were deformed on a 200-ton hydraulic press designed by this institute for hot extrusion of compressor blade forgings.

170. Rolling Worm Gears

"Manufacture of Low Module Worm Gears by the Rolling Method," by S. Ya. Kriger; Moscow, Kuznechno-Shtampovochnoye Proizvodstvo, No 12, Dec 59, pp 21-22

Roller design and technology for rolling worm gears are described. The process was developed at the "Stankonormal'" plant and is claimed to ensure high precision and good surface quality while being highly productive. Gears obtained by this method satisfy all technical requirements and do not require heat treatment due to the work hardening effect.

171. Punching Holes With Explosives

"Noiseless Explosive Punching of Holes," by V. G. Kononenko and K. I. Zaytsev; Moscow, Kuznechno-Shtampovochnoye Proizvodstvo, No 12, Dec 59, pp 15-18

Results are given of investigations to improve an explosive punching process originally developed by D. I. Ostapenko (Authorship Certificate No 4857(335255), 5 Nov 44) which utilized a rifle cartridge as the energy source for punching holes in rails. An industrial model of this device was demonstrated at the Moscow Exhibit in 1958 and it is claimed that the Lockhead Aircraft Corporation, while showing interest in the process, limits information to works conducted on explosive punching of holes in high-temperature and stainless construction materials in particular. A 25-kg experimental portable device is described as having the capacity to punch holes with diameters up to 25 mm in thicknesses of Steel 3 up to 12 mm with high-surface finish.

172. Two Soviet Metallurgical Journals To Be Combined

"Dear Reader" (editorial notice); Stalinsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Chernaya Metallurgiya, No 9, Sep 59 (unattached leaflet)

As of 1 January 1960, the Soviet journals Nauchnyye Doklady Vysshey Shkoly, Metallurgiya (Scientific Papers of the Higher Schools, Metallurgy) and Izvestiya Vysshikh Uchebnykh Zavedeniy, Chernaya Metallurgiya (News of Higher Educational Institutions, Ferrous Metallurgy) will be combined

and published as one journal bearing the title of the latter. The new series will be published in Moscow by Metallurgizdat under the editorship of the Siberian Metallurgical Institute and the Moscow Institute of Steel. Periodicity is not indicated, but it is responsible to expect that the journals will be published at least monthly.

Publication of No 10, 11 and 12 of Izvestiya Vysshikh Uchebnykh Zavedeniy, Chernaya Metallurgiya for 1959 will be delayed, but issues of the new 1960 series will be published on time.

173. Hot Shortness of Aluminum Alloy Castings

"On Hot Shortness of Aluminum Alloys as Related to Melt Overheating," by I. I. Novikov, Candidate of Technical Sciences, and Engr G. A. Korol'kov; Moscow, Liteynoye Proizvodstvo, No 12, Dec 59, pp 21-22

Effects of coarse grain growth and gas content on changes in hot shortness with overheating were investigated in tests on aluminum alloys AL7 and D6. Results show that hot shortness is connected mainly with increase of grain size and expansion of zones with acicular crystals during overheating and not with an increase of gas content. Grain modifiers or pieces of the same metal added to overheated melts cooled to normal temperature will increase the number of centers of crystallization.

174. Shrinkage in High-Alloy Chromium and Chromium-Nickel Steel Castings

"Effect of Modifiers on Shrinkage of High-Alloy Chromium and Chromium-Nickel Steels," by N. S. Kreshchanovskiy, Candidate of Technical Sciences, and Engr M. P. Demin; Moscow, Liteynoye Proizvodstvo, No 12, Dec 59, pp 19-21

Results are given of tests to determine the effect of chemical composition on the kinetics of shrinkage in steels Kh27, 90Kh27, Kh15N25, 60Kh15N25, Kh20N12, and Kh27N12T. Tests on the effect of modifiers on steels Kh15N25 and Kh27 were conducted with titanium, cerium, calcium, and boron. Additions of 0.05% boron and 0.3% calcium showed the greatest effect of shrinkage on steel Kh15N25, whereas 0.3% Ti was most effective in steel Kh27.

175. Intricate High-Temperature Castings From Ceramic Molds

"Casting in Ceramic Molds," by V. M. Kolchinskiy, Candidate of Technical Sciences; Moscow, Liteynoye Proizvodstvo, No 12, Dec 59, pp 2-3

Intricate castings of almost unlimited size (100-kg castings have already been produced) may be made from steel and high-temperature alloys by a new technology employing ceramic molds. The process is based on a new method of single-phase hydrolysis of an ethylsilicate binder and rapid formation of a gel by addition of a small quantity of alkali. Mold filler materials are quartz flower and quartz mold sand. Although molds become perforated with minute cracks after flame treatment, sufficient strength and refractory properties are retained for puring high-temperature alloys at temperatures up to 1,700°C without impairing casting surface quality. Possibilities of casting defects are decreased due to the effects of this cracked texture. Casting temperatures may be increased by application of such ceramic materials as sillimanite, mullite, or aluminum oxides. It is claimed that tolerances achieved with this method approximate those in investment casting.

176. Calorimeter for Refractories

"Automatic Calorimeter for Quantitative Thermal Analysis of High Temperature Steels," by V. Ye. Lyusternik; All-Union Scientific Research Heat Engineering Institute; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 127-129

The construction of a device is described for measuring true specific heat, enthalpy, and heats of allotropic steel transformations is in the temperature range of 50 - 1,000°C with an accuracy of one percent. Experience in using simple thyratron photo relays for maintaining adiabatic conditions in the calorimeter with continuous heat input is described.

[For additional information on metallurgy, see Chemistry, Nuclear Fuels and Reactor Construction Materials and Inorganic Chemistry.]

Mechanics

177. Amplification of Weak Shock in Turbulent Combustion

"On the Possible Mechanism of Amplification of a Weak Shock Wave in a Zone of Turbulent Combustion (On the Theory of High-Frequency Oscillations by Flames)," by K. I. Shchelkin, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Energetika i Avtomatika, No 5, 1959, pp 86-96

The article shows an analytical dependence of a dimensionless pressure gradient in a weak shock wave originating in the combustion chamber of a jet engine on the dimensionless increase of the rate of combustion. It is also shown quantitatively that the passing of the weak shock wave through the combustion zone causes an increase of the velocity of propagation of the turbulent combustion. From a comparison of the two relationships a criterion is derived for the amplification of a weak shock wave in the combustion zone; this criterion is equivalent to that for the emergence of high-frequency oscillations in the combustion chamber.

Nuclear Physics

178. Automatic Pulse Counting Device

"Device for Automatic Pulse Counting," by G. M. Gorodinskiy and V. A. Kochevanov, Leningrad State University; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 81-85

A device is described for automatic counting of the number of statistically distributed pulses. The pulses from the pickup to the input of the device during equal time intervals are recorded on the tape of an electronic recording potentiometer EPP-09 in the form of a histogram. The counting capacity of the ranges of measurements (working with a counting circuit of PS1:256) lies within limits of 50 to $1:3 \cdot 10^6$ pulses over the whole dial. The exposure time may be varied arbitrarily from 2 sec to 16 min. Instrument accuracy in recording the number of pulses is no worse than one % for any range. The device performs reliably and is simple in construction and use.

179. Pulse Recording

"Hodoscope With a Successive Signal Transmission," by I. D. Rapoport, Scientific Research Institute of Nuclear Physics, Moscow State University; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 86-90

Two hodoscopic devices are described, differing by the successive recording of pulses fixed in the hodoscopic channels. Such a recording system has the advantage of application of the hodoscope under conditions of great distance between radiation detectors and the point of signal recording.

180. High-Frequency Ion Source

"High-Frequency Ion Source," by N. S. Nazarov, Physics Institute, Academy of Sciences Ukrainian SSR; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 93-95

A high-frequency ion source with transversal high frequency and longitudinal "resonance" magnetic fields gives, under suitable operating conditions, 300-350 microamperes of current on the target located at a distance of 2.7 meters from the source at a gas discharge of ~ 1 cm^3/hr. The coefficient of gas utilization is almost over 0.3. The source has been tested and is operating on a low voltage stand (~ 100 kv). In accordance with its parameters, it may be used for work on low voltage devices, as well as on an electrostatic generator.

181. Double Focusing of Nuclear Beam

"Double Focusing of a Beam of Charged Particles in a Wide Interpole Gap," by S. A. Kuchay; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 96-97

It is shown experimentally that double geometrical focusing exists between the poles of a magnet with a wide gap.

182. Designing Magnet Shape

"Determination of the Shape of the Magnet Pole With Allowance of the Boundary Effect," by Ye. P. Grigor'yev and A. V. Zolotavin, Leningrad State University; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 97-99

A simple calculating method for pole profile is suggested for the creation of a magnetic field of the required shape. The scattering of the field is obtained by adjusting it for plane poles. The accuracy of the method is ~ 1.5%.

183. Voltage Stabilizer of Accelerator

"Voltage Stabilization in a High-Voltage Accelerator by Means of a Delay Gap," by B. S. Novikovskiy; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 140-141

Stabilization by a device located between the low-voltage lead of the high-voltage source and ground is described. If the zero point of the accelerator is coupled to the ground through an ohmic resistor, then during the transfer of the ionic beam to the grounded target, a voltage difference appears between the last electrode of the accelerating tube and the ground, slowing down the particles of the beam. By adjusting the value of the voltage difference an energy stabilized beam may be obtained on the target.

184. Electron Optical Acceleration System

"Accelerating Tube for Obtaining an Electron Beam of High Intensity," by G. S. Kazmin, Tomsk Polytechnic Institute imeni Kirov; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 5, 1959, pp 14-18

Analysis is made of a simple electron optical system of an accelerating tube with electrostatic focusing of the beam in a setup involving current limitation by a space charge. A method of computation is presented for two cases of current passage corresponding to various characteristic initial conditions of beam propagation. Construction data of an experimental accelerating tube for 250 kv with electron current in the beam up to 1.7 amp in a pulse are presented. This report was presented at the Intervuz Conference on Accelerators in Tomsk, February 1958.

185. Design of Weakly Focusing Accelerator

"Computation of Tolerated Deriations of the Magnetic Field of a Weakly Focusing Accelerator With a Split Magnet," by G. I. Dimov and Yu. K. Petrov, Tomsk Polytechnic Institute; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 5, 1959, pp 19-25

An approximate method is analyzed, consisting of the use of the basic harmonic component of unperturbed free oscillations described by Hill's equation. This method is simpler than previous methods. This method is used to analyze tolerances in accuracy of the equipment and the azimuthal dimensions of sectors of the split electromagnet.

186. Stereobetatron

"The Start of a Double Chamber Stereobetatron for 10 Mev," by V. A. Moskalev and Yu. M. Akimov, Tomsk Polytechnic Institute imeni Kirov; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 5, 1959, pp 26-30

A brief description is given of the construction of the equipment, the feed circuits, and control of the operation of the stereobetatron, as well as some data on radiation of the stereobetatron set into operation in the Tomsk Polytechnic Institute at the end of 1957. This report was presented at the Intervuz Conference on Accelerators in Tomsk, February 1958.

187. Betatron Beam Extraction

"The Extraction of the Electron Beam From the Betatron Chamber," by Yu. M. Akimov, B. A. Kononov, and L. S. Sokolov, Tomsk Polytechnic Institute imeni Kirov; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 5, 1959, pp 31-34

Several methods are under study at the Tomsk Polytechnic Institute for extracting the betatron beam. The electrostatic method consists in a sharp deflection of the accelerated electrons on a specified azimuth by a special condenser. At present, the source of the deflecting high voltage is a peak transformer. The saturating core of this transformer is made of permalloy. It has the advantages of shorter high-voltage pulse, lower weight of the core, and reduction of power supplied to the transformer. A toroidal extractor is now under study. This report was presented at the Intervuz Conference on Accelerators in Tomsk, February 1958.

188. Pulsed Stereobetatron

"A Strong Current Pulsed Stereobetatron," by V. A. Moskalev, M. F. Filippov, A. G. Skorikov, and Yu. M. Skvortsov, Tomsk Polytechnic Institute imeni Kirov; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 5, 1959, pp 35-44

A laboratory of Tomsk Polytechnic Institute, experienced in betatron development, projected the construction of an electron accelerator, permitting head-on meeting of two electron beams. The design was prepared for an energy of the accelerated beam of 25 Mev and current striking the target at several amperes per microsecond. An acceleration of the computed charge equal to microcoulombs was expected to be realized by the creation of an optimal magnetic field, by increasing the interpole gap, by raising the injection voltage and by realizing an oscillationless electron input on equilibrium orbit, facilitated by a new capture mechanism proposed in the laboratory (B. N. Rodimo Izv. vuzov MVO SSSR, Fizika 1, 1958). This report was presented at the Intervu Conference on Accelerators in Tomsk, February 1958.

189. Green's Function Applied to Meson Field

"The Spectral Properties of Green's Function in a Meson Field Model With a Fixed Source," by A. N. Tavkhelidse, I. T. Torgov, and N. A. Chernikov, Joint Institute for Nuclear Research; Moscow, Doklady Akademii Nauk SSSR, Vol 129, No 4, Dec 59, pp, 769-772

Many models were created to surmount difficulties involved in analyzing equations of quantum field theory. Green's function is analyzed and applied to a simplified model of a meson field in interaction with a fixed source. The results do not lead to paradoxes as "negative probabilities."

190. Nuclear Magnetic Resonance

"Nuclear Magnetic Resonance in Polycrystalline Diaspore and Carbon Monofluoride," by N. M. Aleksandrov; Leningrad, Vestnik Leningradskogo Universiteta, No 22, Seriya Fiziki i Khimii, No 4, 1959, pp 24-25

A quantitative study of the Nuclear Magnetic Resonance line shape for H^1 in $HAlO_2$ (diaspore) and for F^{19} in three different samples of $(CF_x)_n (x \leq 1)$ has been carried out. The second moment of proton resonance in diaspore, found to be $9.11 \pm 0.7 gs^2$ proved to be lower than the known minimum of intermolecular values of ΔH^2 conditioned by proton interaction in a water molecule, which, according to J. Itoh et al (J. Chem. Phys, 21, 1895 (1953)) is $\Delta H^2 = 17.5\ gs^2$. The O - H distance in diaspore crystal was evaluated.

191. Device Using Zeeman-Modulation

"A Device for Observation of Nuclear Quadrupole Resonance by Zeeman-Modulation," by V. S. Grechishkin; Leningrad, Vestnik Leningradskogo Universiteta, No 22, Seriya Fiziki i Khimii, No 4, 1959, pp 19-24

A simple device for nuclear quadrupole resonance observation directly on an oscilloscope screen without any phase detector is described. A super-regenerative oscillator and zeeman-modulation was applied for studying the type of bonds in a number of molecular crystals. The device proved to be reliable and have high response.

192. Soviet 10-Bev Synchrophasotron

Sinkhrofazotron (Synchrophasotron), by V. I. Orlov and V. N. Trostnikov; Moscow, Znaniye, Series 9, Fizika i Khimiya, No 22, 1959, 31 pp

The 10-Bev synchrophasotron was designed and constructed by V. I. Veksler, F. A. Vodop'yanov, D. V. Yefremov, L. P. Zinov'yev, A. A. Kolomenskiy, Ye. G. Komar, A. L. Mints, N. A. Monoszon, S. M. Rubchinskiy, V. A. Petukhov, M. S. Rabinovich, and A. M. Stolov, all awarded the Lenin Prize in April 1959. Among these scientists, A. A. Kolomenskiy and M. S. Rabinovich were trained by V. I. Veksler.

The magnet is 60 meters in diameter and weighs 36,000 tons. The injector is a linear accelerator with a preliminary injector which ionizes hydrogen by a discharge of 600,000 volts. These protons are injected into the linear accelerator flying through a row of gaps until at 9 Mev -- a velocity of 40,000 km/sec -- they enter the synchrophasotron and are bent by the Lorentz force into the equilibrium trajectory. Between the output of the linear accelerator and the input into the synchrophasotron, the particles pass a 10-meter gap by inertia and are focused by a magnetic lens. It is possible to shift the proton beam in parallel. After these 10 meters, the particles meet a magnetic device which bends the trajectory and forces the protons into precalculated orbit inside the 200-meter hollow torus ring, evacuated to 10^{-6} mm Hg. Every fourth of the circle an accelerating gap gives the protons a kick of 1,000 ev and decreases the amplitude of betatron oscillations.

The 10-Bev synchrophasotron was conceived in the accelerators laboratory, Physics Institute imeni Lebedev, Academy of Sciences USSR. Previously, an electron synchrotron of 30 Mev and proton synchrocyclotron of 250 Mev had been constructed, providing work experience for the men working on the 10-Bev synchrophasotron.

In January 1957, adjustment of the unit as a whole was begun. On 15 March, so-called betatron regime was achieved. A week later, proton acceleration to 2 Bev was attained, and on 16 April, design energy of 10 Bev. Work on the machine continued in 1958 leading to a 1,000-10,000-fold increase in proton beam intensity and reliability of synchrophasotron operation.

In 1959 beams of secondary particles were formed and directed into the measuring room 40 meters from the accelerator. Chief among these were a beam of negative antihyperons, irradiating a large propane bubble chamber; a beam of negative pions, irradiating a small xenon chamber and also used with a large Wilson chamber; and a beam of positive particles, mostly positive pions studied by counters.

The results were presented by V. I. Veksler at the Ninth International Conference on High Energy Physics at Kiev in July 1959.

Among those working at Dubna, home of the synchrophasotron, are K. D. Tolstov and M. I. Podgoretskiy, guiding P'u Ying and Wang Shu Feng from China, Pavel Markov from Bulgaria, Tuvendorzh and Dakhazhov from Mongolia, and Tsoy Yung Gir from Korea in photoemulsion work with 9-10 Bev protons. I. V. Chuvilo is the head of a group working on methods of recording nuclear phenomena.

New methods for still higher energies are being worked on by V. I. Veksler (coherence method), Ya. B. Faynberg (plasma wave guides), and G. I. Budker (stabilized beam).

Professor Budker's project is aimed at condensing an electron beam to a pinch in a ring-shaped chamber. Such a pinch should produce a strong magnetic field, usually used in accelerators. If the protons are injected into the electron pinch at the right instant, they may be accelerated to high energy by the usual means. Thus the pinch will replace the massive and expensive magnetization equipment and reduce the dimensions and radius of the vacuum chamber by tenfold and more.

193. Soviet Atomic Power Stations

Atomnyye Elektrostantsii (Atomic Power Stations), by A. K. Krasin; Moscow, Znaniye, Series 9, Fizika i Khimiya, No 25, 1959, 23 pp

The development of nuclear power engineering in the past 5 years is reviewed. Data given on Soviet developments follows.

The first Soviet atomic power station (APS-1) is located at Obninskoye, 66 miles southwest of Moscow. Its heat rating is 30,000 kw and electric power rating is 5,000 kw. The reactor is graphite moderated, water cooled with 128 tubular uranium fuel elements. The cylindrical graphite core is 3 meters in diameter and 4.6 meters high. It has 157 vertical channels 65 mm in diameter making a triangular lattice of 120 mm pitch. Of these 157 channels, 128 carry fuel elements, the rest control rods and other equipment. The reflector around the core is of graphite. On the sides the reactor is surrounded by a ring-shaped water-filled tank 100 cm thick, forming a part of the shielding. A special water loop cools this water tank. The tubular fuel elements have an external diameter of 9 mm and the walls are 0.4 mm thick. The active fuel is located in the gap between the inner and the outer tubes, the latter 14 mm in diameter and 0.2 mm thick. The uranium fuel consists of a grit of U-alloy with 9% molybdenum, coated with magnesium. The external cassette tube traps the fission fragments. The cassette is of stainless steel 1Kh18N9T; the inner tube resists a water pressure of 100 atmospheres. The control rods are of boron carbide or boron steel.

The power station is divided into two circuits. The first water loop uses water at 100 atmospheres. The first circuit includes the reactor, the heat exchangers, the water loops and pumps, tubular ducts and armatures. The heat of the first pressurized water loop is transferred to the water loop of the second circuit. The second circuit contains the turbine, the turbine condenser, and the feed pump. The turbine condenser is cooled by water fed by a separate pump from the spray tank. The first water loop track is of stainless steel 1Kh18N9T, the second loop track of carbon steel. The water of the first loop is at 190° and returns at this temperature; the second loop provides steam under 12.5 atmospheres and at 260° C.

The control of the whole station is centralized at one single panel. Five years' operational experience have proved the station reliable in all respects.

Future Soviet Atomic Power Stations

A boiling water reactor was selected for the next atomic power station. Its advantage is to reduce the dimensions of the active zone and to use one pressurized vessel at 100-140 atmosphers with a heat transfer agent at 300-350° C. Each reactor has a heat rating of 700 Mw, and will supply steam to three turbines each coupled to a 70-Mw electric generator. The heat transfer agent, as well as moderator, will be light water at 100-atmosphere pressure. The diameter of the active zone will be 3 meters; the height, 2.5 meters. The water flow in the active zone must be 7.6 m/sec to provide a circulation of 273,000 m^3/hr. The fuel elements will be made of sintered uranium dioxide enriched to 1.5% of uranium 235. The active zone contains 349 hexagonal subassemblies of zirconium clad fuel elements. The subassembly casing is 165 mm in diameter (circumscribed circle), with walls 2 mm thick. They are arranged in a triangular lattice with a 147-mm pitch, and are 3.2 meters long.

The cylindrical reactor vessel is 3.8 meters in diameter and 12 meters high, with a flat cover and an elliptical bottom. The wall thickness of the vessel is 100 mm in the lower part and 180 mm in the upper. The upper part has outlet pipes connecting the vessel to six loops carrying the heat transfer agent. The water entering the outlet pipes flows between the vessel and the protective shielding. In the lower part of the vessel, the water flows through the central part of the vessel and around the subassemblies. The heated water leaves through the outlet pipes in the upper part of the vessel into the six loops and enters the heat exchanger of the station.

The control of The reactor is effected by absorption rods and movable fuel subassemblies. The refueling may be done by removing of the upper cover, under the protective layer of 5 meters of water.

The station will operate on the principle of a two-circuit system.

194. Yugoslavs Start Operation of New Nuclear Reactor in Vinca

"Eighth Reactor in the World" (unsigned article); Belgrade, Borba, 29 Dec 59, p 8

The article comments briefly on the new 6.5-10-megawatt research nuclear reactor built at the "Boris Kidric" Institute for Nuclear Science in Vinca. The article contains several photographs, such as the external panoramic view of the nuclear reactor complex, views of the upper and lower parts of the body of the reactor before and after installation, the top of the reactor, the graphite shield, the pumps for circulating the heavy water, and the control room.

Spectroscopy

195. Field Strength and Ion Concentration in Arc Discharge

"Behavior of Field Strength and Ion Concentration in an Arc Discharge on the Basis of Time Spectra," by Arpad Bardocz, Tibor Voros, and Marta U.-Vanyek, Spectroscopy Department, Central Physics Research Institute; Budapest, Magyar Fizikai Folyoirat, Sep/Oct 59, pp 375-384

The behavior, with respect to time, of ion concentration and field strength in an arc discharge was studied with the aid of time spectra of Mg, Zn, Cd, and Hg. The field strength was determined in keeping with Unsold theory, the ion concentration in keeping with Holtsmark theory -- in both cases on the basis of the shift of spectral lines. In the arc lines for Mg, Zn, Cd, and Hg, the maximum field strength was 600 kilovolts per centimeter, and ion concentration was about 10^{18} ions per cubic centimeter. Measurements were made of the changes in the field strength and ion concentration with respect to time. Field strength and ion concentration are both greatest in the initial period of the discharge, thus the strongest Stark effect takes place at this time also, as well as the maximum shift of the spectral lines. As time passes, the temperature of the arc line decreases, as do field strength, ion concentration, and line shifting. After the field strength decreases below a certain limit, the lines return to their normal wave-length positions.

196. Resonator in Magnetodielectric Medium

"The Spatial Resonance in a Helical Wave Guide Placed in a Magnetodielectric Medium," by V. P. Shestopalov and B. V. Kondrat'yev, Kharkov State University imeni Gor'kiy; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 29, No 12, Dec 59, pp 1434-1456

Equations of dispersion were derived for a helical wave guide placed in a magnetodielectric medium, and the causes of the appearance of a spatial resonance in such a system were studied. Special attention was paid to the analysis of delay in the system $\beta_o^{\pm}$ and $\beta_n^{\pm}$ in relation to frequency at various values of ε, μ and for various mutual positions of the helix and the magnetodielectric.

197. Diffraction of Electromagnetic Wave

"Diffraction of a Plane Electromagnetic Wave on an Ideally Conducting Round Disk," by K. A. Lur'ye, Physicotechnical Institute, Academy of Sciences USSR; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 29, No 12, Dec 59, pp 1421-1433

The theory of pair integral equations is applied to an accurate solution of the diffraction of a plane electromagnetic wave on an ideally conducting round disk for a general case of incidence. It is shown that the amplitudes of harmonics of the components of the total current density in the disk may be expressed by quadratures of introduced auxiliary functions. These functions are solutions of Fredholm's integral equations of the second kind with kernels found in tabulated functions.

198. Spontaneous Decay of Arc Discharge

"Phenomena of Internal Instability of an Arc With a Mercury-Pool Cathode. I. Spontaneous Arc Decay," by I. G. Kesayev, All-Union Electrical Engineering Institute imeni Lenin; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 29, No 12, Dec 59, pp 1462-1472

This article is the first of a series devoted to the study of stability of a low-pressure arc with a mercury cathode. Statistical results of spontaneous arc decay in the region of weak currents are presented for preplanned varying test conditions. As a characteristic of arc decay under various conditions, the duration of the arc discharge is taken. This duration is analyzed in relation to parameters of the external circuit and to the internal conditions of discharge.

199. Recording Micrometer

"Raster Recording Micrometer," by V. R. Regel and V. G. Govorkov, Institute of Crystallography, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 4, Jul/Aug 59, pp 133-136

A measuring device for small displacements is described, based on photoelectric measurement of the light flux, passing through a system of two mutually shifting rasters. The model of the raster micrometer prepared permits measurement of displacements of 10 mm with an accuracy of 0.1 micron.

200. Importance of Correlation (Energy) Motion of Electrons in Eigenfunctions of Binding Energy of Hydrogen Molecule

"Concerning the Role of Electron Correlation /Energy/ on the Elementary State of the Hydrogen Molecule," by Ferenc Berencz, Institute of Theoretical Physics, Szeged University; Budapest, Magyar Fizikai Folyoirat, Sep/Oct 59, pp 385-399

An investigation is made of the electron correlation (energy) which appears in the eigenfunctions of quantum mechanical calculations of the hydrogen molecule. Exact and semiempirical eigenfunctions were divided into groups of eigenfunctions containing implicit and explicit electron correlations, the valence bond and the MO /shell?/ calculations being considered in the first group, and the CMO /shell?/ calculations in the second group.

On the assumption that the best value for the binding energy of the hydrogen molecule (obtained by James and Coolidge) is D = 4.27 electron volts, it is concluded that the experimental value of the binding energy of the hydrogen molecule can be approximated only by those exact eigenfunctions which take into consideration the correlation (energy) motion of the electrons, and that this fact must be considered in the derivation of eigenfunctions.

201. Classical Explanation for Velocity Distribution in Quantum Theory

"Interactions of a Uniform Field and Electrons," by Balint Fogarassy, Electromagnetic Waves Department, Central Physics Research Institute; Budapest, Magyar Fizikai Folyoirat, Sep/Oct 59, pp 355-373

With the complete Lorentz force taken into account, a series factorization method is used to determine electron velocity as a function of the vector potential. For the case of a uniform electromagnetic field, the values of the velocity distribution computed on the basis of quantum mechanics and on the basis of classical theory both led to the same result. In one case, where the

actual velocity value was computed, it was found that correction terms appear which had been previously interpreted on the basis of quantum theory (I. R. Senitzky, Physical Review, 95, 904, 1954). It is considered obvious here that the correction terms result primarily from classical distributions, whereas quantum theory sets only limiting values of these terms pertinent to an idealized case. The formulas also show that classical and quantum mechanical effects (interactions) cannot be considered independently unless the former are eliminated completely. It is also shown that the interaction of a uniform electromagnetic field and free electrons is of a classical nature from the viewpoint of the movement of electrons, and a calculation method for handling such problems is given.

The author expresses thanks for the advice of Tibor Hoffmann, Doctor of Physical Sciences.

Miscellaneous

202. New USSR Physics Encyclopedia Announced

"Physics Encyclopedic Dictionary," by Academician P. Rebinder; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, Vol 5, No 14 (622), 3 Feb 60, p 4

The five-volume physics encyclopedic dictionary which was published 20-25 years ago has become a bibliographic rarity. Most of this dictionary is now hopelessly out of date.

The Scientific Publishing House "Sovetskaya Entsiklopediya" (Soviet Encyclopedia) has initiated the publication of a four-volume physics encyclopedic dictionary which is designed to serve the needs of persons who encounter problems of contemporary physics in their practical activity. The dictionary will contain more than 6,500 articles, each of which will give a brief exposition of the subject in question. For those who will want to become thoroughly familiar with the subject, there will be a bibliography at the end of every article; this bibliography will list the most important monographs, handbooks, reviews published in periodicals, and papers on the subject which appeared in the Russian language and in foreign languages. The articles will contain reference data on different physical constants and on properties of substances, the characteristics of processes, etc. The dictionary-encyclopedia will contain about 4,000 illustrations. Particular attention will be paid in this encyclopedia to problems in different fields of present-day physics, including the theory of nuclear processes, the mechanics and thermodynamics of processes involved in various types of reaction motion, magnetic hydrodynamics, physics and physical chemistry of polymers and semiconductors, the physicochemical mechanics of materials, the behavior of materials at elevated and low temperatures, the effects of high pressures and radiation on materials, etc.

The articles published in the encyclopedic-dictionary were written by prominent specialists in the scientific fields in question.

The first volume of this dictionary, which consists of 1,600 articles, has already been prepared for publication and will appear in the first part of 1960.

X. MISCELLANEOUS

203. New Soviet Journals Available

"New Journals of the Siberian Department of the Academy of Sciences USSR" (unsigned article); Moscow, Izvestiya Akademii Nauk SSSR, - Seriya Fizicheskaya, No 12, Dec 59, back cover

In January 1960, the Siberian Department of the Academy of Sciences USSR was to begin publication of the following five new scientific journals:

Geologiya i Geofizika (Geology and Geophysics), monthly

Zhurnal Prikladnoy Mekhaniki i Technicheskoy Fiziki (Journal of Applied Mechanics and Engineering Physics), quarterly

Zhurnal Strukturnoy Khimii (Journal of Structural Chemistry), quarterly

Kinetika i Kataliz (Kinetics and Catalysis), quarterly

Sibirskiy Matematicheskiy Zhurnal (Siberian Mathematics Journal), quarterly

Original articles of a theoretical and experimental nature containing results of scientific works, as well as discussion and review articles will be published in the journals.

Subscriptions to the journals are being accepted by the office of the "Akademkniga" Publishing House at the address: Moscow, K-12, B. Cherkasskiy per., 2/10.

204. Hungarian Federation of Scientific Associations Described

"The Social Activity of 47,000 Engineers and Technicians," by J. K.; Budapest, Nepszabadsag, 7 Jan 60, p 3

This article is based on the statements made to the press by Dr Endre Valko, first secretary of the Federation of Technical and Natural Science Associations (Muszaki es Termeszettudomanyi Egyesuletek Szovetsege, MTESZ). The 25 member associations have about 47,000 members, one third of whom are from the provinces. The various associations organize conferences on automation, industrial planning, etc. In almost every case, men from the ministries or from the National Planning Office actively participate in the leadership of the associations. The associations publish 40 technical journals which appear each month in nearly 70,000 copies (85,000 copies counting Muszaki Elet, the federation's monthly). The associations also organize attendence at foreign conferences.

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